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Frozen Foods.

THE MOST spectacular event of the last few years —so far as the food industry is concerned—is the application of " quick-freezing " or " rapid-freezing " methods to the preservation of perishable foods. A new industry has sprung up overnight—so to speak—and it shows every promise of very soon becoming an industry of vast importance.

Like many other instances of its kind, this sudden outburst has a background of arduous work, painstaking research, failures, disappointments, and gradual progress in face of countless difficulties. In February of this year, the British Frozen Meat Trade celebrated, in honour of Thomas Mort, the fiftieth anniversary of the first successful shipment of frozen meat from Australia; and the first recorded attempt to freeze fish and store them in a frozen state dates back nearly seventy years, when a patent was issued to Enoch Piper, of Camden, Maine, in 1861. But freezing, as practised until recently, has been exclusively carried out at temperatures which, compared with the " rapid-freezing " methods, are not particularly low, and the rate of freezing has been relatively slow. The trouble with slow-freezing is that damage to the tissues is likely to result by the formation of large ice crystals, and when the product is thawed the water is only partly reabsorbed by the damaged cells, and there is a loss of soluble albumens and salts—thus affecting adversely its flavour, texture, food value, and appearance. Rapid-freezing, on the other hand, results in the formation of smaller crystals, which have not the same destructive effect.

Fish and Meat Freezing.

In U.S.A., where most of the developments have taken place, there are more than thirty large companies now employing some type of the rapid-freezing process, and practically every perishable commodity has been treated with some success. So far, the method has been most extensively applied to fish. During 1929, 121,543,000 pounds of fish were frozen by 121 public and private plants in U.S.A. The usual practice adopted is to clean, bone, and sometimes skin the fish. They are either frozen and then packed in hermetically sealed cartons, or they are frozen in the package. The same methods are applied to meat, cuts being shorn of bone and waste in advance and sealed in containers.

Details of the various methods used for freezing and of the histological changes which take place have been described at considerable length in many publications; thus C. Birdseye (*Ice and Refr.*, 1930, June, p. 547); H. F. Taylor (*Ibid.*, August, p. 111); W. Stiles (Food Investigation Board, Report No. 7, 1922).

Distribution.

The expansion of the frozen foods industry is largely a problem of distribution, and this problem centres on the maintenance of low-temperature conditions during transit and display. Research has developed several types of containers made of vegetable parchment or corrugated board that can withstand changes in temperature for long periods without further protection. However, refrigerator cars are frequently used for transit, and the goods are generally displayed in refrigerated glass cases. Obviously this development represents a large potential demand for refrigerating equipment of all sorts.

Advantages.

Granted, as seems reasonable, that these problems of distribution will shortly be adjusted, rapid-frozen foods offer three definite advantages: (1) The distribution, at home and abroad, of a wide variety of perishable foodstuffs in standardised packages and at standardised prices; (2) the smoothing out of seasonal variations in production; (3) the reduction of waste by shipping from the point of production only edible portions of the product.

The Future Store.

Within eighteen months, predicts the President of General Foods Corporation, American housewives will be able to purchase fresh orange juice in frosted cubes across the grocery counter, and eventually all perishable foods, such as fruits, vegetables, fish, and meat will be sold in clean, sanitary cartons. Seasons and distances will be wiped out, housewives freed of a little more drudgery, and delicate, perishable foods controlled and handled without waste. The dingy, musty establishment of the old-time grocer who was content to sit on his pickle barrel and wait for business to come to him is happily becoming only a memory—or a nightmare.

Frozen Fruits.

The freezing of fruits and berries by the "Cold Pack"—or, as Diehl prefers, the "Frozen Pack"—method has been practised for about twenty years, using fifty-gallon barrels, either with or without the addition of sugar. In 1929, 100,000 barrels of frozen products were marketed on the Pacific coast, and in U.S.A. some 30 million pounds of strawberries were frozen. The practice has met with more or less success—depending on the knowledge and experience possessed by the operator. It is only recently that the attention of the U.S. Department of Agriculture and other scientific bodies has been concentrated on the problem, and in particular on the precise conditions to be observed for the freezing of berries and fruits in small containers. This phase of the industry is still young, but appears to offer considerable promise and is at the moment being discussed with enthusiasm. It is stated that sufficient experimental data have been assembled to permit commercial packs of good quality, but that many important points yet remain to be settled. The temperature best adapted for freezing fruits and vegetables in general commercial practice is given by Diehl as about 0° F. The same authority states that, with adequate refrigeration available, the problems of sufficiently, but not necessarily excessively, rapid cooling of frozen pack in small containers should be relatively easy of solution, if some methods can be devised for cooling them individually after packing, rather than after they have been assembled in cartons or boxes for shipping, as is generally done at present.

For further information of work on this subject the reader should consult H. C. Diehl (*Technical Bulletin* 148, *U.S. Dept. of Agriculture*, January, 1930, and *Ice and Refr.*, 1930, July, p. 55); W. A. Taylor (*Ice and Refr.*, 1930, July, p. 26); M. S. Joslyn (*Ice and Refr.*, 1930, September, p. 215), and J. E. McConkie (*Ice and Refr.*, 1930, October, p. 293).

Decomposition of Fish.

J. R. Sanborn (*Journ. Bacteriology*, Vol. 19, June, 1930, pp. 375-382) gives an interesting study of the various types of marine bacteria, their proteolytic power, and attempts at their identification. This author in his conclusions states that marine bacteria are consistently present in and on fresh fish and in smoked and frozen fish. They are active at relatively low temperatures, and many of them engage in proteolytic processes in fish muscle.

Organisms belonging to the intestinal genera are invariably present in the visceral cavity of split fish and probably come from the alimentary tract. Some definitely putrefactive forms are included in this group, which are active in the decompositions of fresh and frozen fish. The removal of contaminated material from the visceral cavity by washing is a wise precaution. Improved and more careful methods of handling will probably result in better keeping quality.

Iodine in Canned Fish.

Dr. G. Lunde, Director of the Research Laboratory of the Norwegian Canning Industry, has been carrying out researches into the iodine content of Norwegian canned fish. These have demonstrated the fact that such foods constitute an important source of iodine. Thus, in a table which he gives showing the average results of his investigations (*Tidsskrift for Hermetikindustri*, 1930, September, p. 233), the average iodine content of smoked brisling (in olive oil) is given, in milligrammes per kilo, as 1·2 (moist) and 2·78 (dry); of kippers, 1·02 (moist) and 2·76 (dry); and of cod roes, 1·92 (moist) and 6·84 (dry).

Stockings from Monkey Nuts.

Almost every day there are advances made in the utilisation of waste food products. One of the latest to receive attention is the vast quantity of shells from the peanuts which form so large an item in the American dietary list. The Farm Wastes Division of the American Department of Agriculture has been making experiments in this direction at the Arlington Farms Station in Virginia, and the result of the research has been to show that the husks contain about 90 per cent. of alpha-cellulose. This can be freed from impurity without undue trouble and expense, and is an excellent raw material for the manufacture of rayon used in ever-increasing quantities for the making of "artificial silk" stockings and other fashionable clothing. The enormous trade in monkey nuts in Virginia and the surrounding States gives rise to vast accumulations of hulls which were hitherto a nuisance and used only for fuel. The supply of raw material for this new cellulose production is

plentiful and cheap, amounting, it has been estimated, to something approaching 70,000 tons per annum.

Market for Jams in Burma.

As in the case of other sweet-tasting products, the consumption of jams is expanding in Burma, but to natives even of the middle classes it is a luxury. Consequently, the economic depression prevailing in 1928 resulted in reduced Burmese importations of jams and jellies. These imports were as follows:

	Twelve Months ending March 31.		
	1927.	1928.	1929.
Countries of Origin.	*Weights Pounds.*	*Weights Pounds.*	*Weights Pounds.*
United Kingdom ...	120,288	132,160	166,544
Tasmania	33,040	58,464	25,648
United States	448	1,792	448
Other Countries	46,144	48,272	21,952
Totals	199,920	240,688	214,592

British jams and jellies, including marmalade, are most extensively sold because the majority of the English residents prefer the products and brands to which they have been accustomed since childhood. Tasmanian jams are cheap and sell well for that reason. There are also several English brands which are sold on a price basis.

American jams are in general too high priced for the market, and are consumed chiefly by resident Americans. The existing combination of English preferences and low prices limits the sale potentialities for American products.

Jams and jellies are not made commercially in Burma, but guava jelly from other parts of India is on sale locally.

South Seas Whaling Industry.

The South Sea whaling season was concluded in the beginning of June, 1930, with a total yield which exceeded the foregoing season's catch by about 55 per cent. The South Sea production in the 1928-1929 season amounted to 1,631,340 barrels, whereas the output during the season under review totalled 2,532,445 barrels; in 1926-1927 it amounted to 872,316 barrels.

In the 1926-1927 season there were in operation 6 land stations, 3 of which were Norwegian; 17 floating factories, of which 14 were owned by Norwegians; 17 floating factories, of which 14 were owned by Norwegian companies; and 79 whaling-boats, 58 of which were Norwegian. During the past season, however, there were in operation in the South Sea fields 3 Norwegian and 3 foreign land stations; 28 Norwegian and 9 foreign floating factories; and 130 Norwegian and 53 foreign whaling-boats.

Twenty-four Norwegian companies participated in the whaling activities in the South Sea fields during the 1929-1930 season. The value of the production is estimated at nearly £7,000,000, to which must be added the returns from the guano production, about £100,000.

Denatured Alcohol Danger.

During last February and March thousands of cases of paralysis occurred in America following the drinking of Jamaica ginger wine. It has now been established by Dr. Smith, of the United States Hygienic Laboratory, that the adulterant which was the cause is the phosphoric ester of tricresol, which was found in all samples of the ginger from shipments that had caused the cases of paralysis, whereas the samples from lots which did not cause paralysis did not contain it.

Animal experiments were carried out on rabbits, monkeys, and dogs, and the two latter animals were not affected, but the rabbits became paralysed in the limbs and died from respiratory failure. When the compound was broken down chemically and the products of hydrolysis administered to dogs and monkeys they, too, were affected. Thus it would appear that it passed straight through the stomachs of dogs and monkeys but was broken down in the organs of man and rabbit.

It is suggested that the source of this substance was the alcohol used in the preparation, in which it had been used as a denaturant. The moral is obvious, and no discriminating food manufacturers should be found guilty of using denatured alcohol in any of their preparations.

Sulphur Dioxide and Vitamins.

There are many so-called health foods on the market, including high priced special preparations of sun dried and unsulphured fruits. It has recently been shown (Morgan and Field, *J. Biol. Chem.*, 1930, Vol. 88, pp. 9-25) that the sulphured dehydrated fruits are without exception superior in vitamin content to the unsulphured ones.

The protective effect of sulphur dioxide on the vitamin C of dried peaches had been previously reported by the same workers (*J. Biol Chem.*, 1929, Vol. 82, p. 579), and they have now carried their investigations to the vitamin A of fruits. They studied the vitamin A content of frozen, fresh, and variously dried samples of peaches, prunes, and apricots by a uniform biological technique. The dehydrated fruit, which had been treated with sulphur dioxide, in all cases appeared to retain the largest proportion of the vitamin, but this retention was not directly related to the amount of sulphur dioxide in the fruit. The conditions which favour retention of both vitamin A and C in dried fruits do not meet

with popular or official approval, and the regulations regarding the use of sulphur dioxide are very stringent. Certainly the increasing knowledge of the vitamins and their behaviour in various conditions will have a big influence on methods of food preparation and storage. The time is not yet ripe for any dogmatic statements, but evidence is slowly being accumulated by many researches, and out of the mass of collected data some useful fact must emerge sooner or later.

The Age of Flour.

One of the problems of the cereal chemist is the determination of the age of flour. It is also one of the concerns of the baker and confectioner. So far the method of estimating age has been rather empirical, and such factors as feel and smell have played important parts in the determination. Recently Hartmann has attacked the problem more systematically by examining the changes which occur in the acid number (c.c.$_5$ of 0·1 N NaOH required for titration), the refractive index, gluten nitrogen, and lecithin phosphate contents. He found that the acid value increases with time of storage rapidly at first from 54 to about 240 after 15 months. The refractive index, gluten nitrogen, and lecithin phosphate contents fall on storage at a rapid rate, the latter falling from 6 to 1·3 mgms. per 100 gms. flour. It is usually assumed that flour is no longer suitable for baking purposes after six months' storage, and Hartmann suggests that the maximum permissible acid values should normally be 90 to 100 for 60 per cent. wheat flours. The acid value and refractive index are determined on a chloroform or petroleum extract of the flour.

Food Poisoning by Eggs.

During the last three years at least seven outbreaks of gastro-enteritis have apparently been caused by the consumption of eggs, in each case duck eggs. Lecoq, in his monograph on poisoning by whipped cream made from cream, gelatin, and white of egg, shows that the poisonous properties appear most commonly in summer, and are due, not to metallic poisons or to putrefactive products such as tyrotoxin, etc., but to bacterial infection of the egg albumin. According to Lecoq, infective material is introduced into the oviduct of the bird during copulation, with infection of the albumin as it is being deposited round the yolk. Scott has recently found that eggs, both of ducks and hens, can become infected when immersed for a few days in cultures of *B. Aertrycke*. If the culture is simply allowed to dry on, infection fails; part of the shell must be moistened for penetration to occur. At first the organism multiplies slowly in the eggs, but as the infected egg grows staler multiplication becomes rapid and countless colonies appear. Such an egg may appear only slightly stale and would not be destroyed by every cook. Whilst the risk of poisoning caused by consumption of eggs is not very great, there can be no doubt that attacks of gastro-enteritis due to this cause are more common than is generally supposed, and here is a potential source of infection against which the food manufacturer must be on guard.

Photosynthesis.

Food manufacturers have been following Professor Baly's researches on photosynthesis of sugars with great interest. It is a fascinating problem. Can we ever imitate the multitudinous activities of green plants on a commercial scale and so store up the energy of the sun in a way that it can be used as food for man? So far the food supply of the whole world depends on the activity of plants which build up starches and sugars from the water and carbon dioxide of the air. The synthesis on paper seems simple enough, but how in the laboratory or in the factory can we supply those waves and energy which bring about the combination so completely in the growing plant? Surface action—that is, the electrical and chemical conditions which are set up where two different substances meet—has much to do with all vital activities. Photosynthesis in the laboratory must be a photochemical action on a surface. The carbon dioxide attached in a special electrical state on a suitable surface of a very fine powder is irradiated. The first surface used was nickel carbonate, but now the best results are obtained by ferric oxide deposited on kieselguhr coated with aluminium hydroxide, which does not become poisoned as the nickel did. A small amount (up to 2 per cent.) of thorium oxide assists the reaction. The photosynthetic efficiency of the powder increases from the blue to the red end of the spectrum just as it does in plants. Temperature plays a similar part. In living plants photosynthesis reaches a maximum of 36° C. In the laboratory the optimum temperature is 31° C.

So far only minute quantities of sugars have been made this way, and the process would be very costly, so those interested in the production of cane and beet sugar need have no immediate qualms, but here is a possible food industry in its cradle. What its life-story will be none can tell, but the germ of life is there, and the baby is being tended with care by Professor Baly and his co-workers. The world was once dependent on terrestrial nitrates for its fertilisers—now the vast reservoirs of the air are being tapped. Once our indigo and alizarine were produced by plant activities, but now are factory made. What has happened in the past may well happen again, for science is untiring, progress is its motto, and the world's food supply will always be one of its chief considerations.

Dry Ice and its Uses

BY L. J. HYNES.

Certain highly important developments in the manufacture and utilisation of dry ice are taking place on a large scale, both in America and on the Continent. In these England has so far played practically no part at all, although the conditions here are particularly well adapted to the use of dry ice as a refrigerant for foodstuffs. However, dry ice is likely to be marketed here within the next few months. The author gives a survey of the latest information available on the subject.

DRY ICE, regarded as a commercial refrigerant, is a development of the last four years, the first important sales having been made, in America, in May, 1926. The new "Carba" process of manufacture, which has lately been patented, appeared in March of 1929 at the Leipsic Fair, since when the number of Continental factories has been increased enormously. Developments in America have been similarly rapid. In the neighbourhood of New York alone there are two large factories, each with a productive capacity of some fifty tons per day, while two others are in process of construction for the manufacture of dry ice by the "Carba" method, and their productive capacity will in each case be about twenty tons per day.

In connection with these important developments England has so far played practically no part at all. The new refrigerant is eminently suited to the conservation of ice-cream; yet the only firm of any consequence to utilise it for this purpose has been that of Messrs. T. Wall and Sons, who have used dry ice, manufactured on their own plant, in all their tricycles since the season of 1928. There has been no serious attempt to market the product for general distribution, while experimental work with a view to exploring the full possibilities of the refrigerant has been absolutely *nil*. This has been left to Americans, on the one side of us, and to Swiss, Belgian, and French companies on the other. However, such enterprising people having done the spade work, having proved that, very briefly, dry ice can be utilised to serve practically all the purposes which water ice serves—and, be it added, very much more efficiently—there are indications that we in England are no longer disposed to ignore the product. It will probably be marketed here, in much the same way as ordinary ice, within the course of the next few months.

Physical Properties of Dry Ice.

To get a clear idea of the manner in which dry ice functions as a refrigerant, and to appreciate fully its undoubted superiority over water ice, it is necessary to understand something of its physical properties.

Dry ice is solid carbon dioxide—solidified liquid CO_2. In the form of crystal it can be obtained by freezing liquid CO_2 in a colder medium—*e.g.*, liquid air, when its specific gravity is 1·56. For practical commercial purposes, however, it must be produced in the form of solid blocks, the consistency of which is about that of chalk, and its specific gravity is then either from 1·1 to 1·2, or about 1·4, according as it is produced by one or the other of two essentially different processes. Both of these will be briefly described in due course.

The temperature of solid CO_2 at atmospheric pressure is approximately −79° C. (−110° F.). When brought into contact with a warmer substance it sublimes, or evaporates, into a dry, odourless, non-poisonous, non-inflammable gas at −79° C., its latent heat of vaporisation being 246·6 B.T.U. per lb. The cold gas so generated can itself absorb, in reaching a temperature of zero C., a further 27 B.T.U.s, so that, in practice, the total capacity of solid CO_2 for absorbing heat, when working at zero C., is 273·6 B.T.U. per lb.

This cold gas, the product of sublimation, is heavier than air, its density being 1·529 while that

Dry Ice Container for use in Long Distance Transport.

When the refrigerant is required for cabinets, it is delivered in blocks of suitable shapes.

Another Dry Ice Container.

of air = 1. Therefore, if a block of dry ice is placed in, say, a refrigerating chamber, the cold gas immediately generated will descend, driving out the air from the chamber, and enveloping the substances to be cooled in its own cold mantle. The outside air being thus excluded, so also must be the bacteria therein. The action of the gas, besides being refrigeratory, is therefore protective. It has no contaminating effect whatever, and in no way injures metals. The dry, insulating envelope is constantly renewed as long as the dry ice lasts, and the latter eventually disappears without leaving a trace behind. Compare the atmospheric humidity, to say nothing of the other nuisances, inevitably associated with water ice.

Processes of Manufacture.

The basic raw material for the production of dry ice is liquid carbonic acid gas. The gas can be obtained from natural wells and springs, or it can be produced artificially—*e.g.*, by the combustion of coke. It is also a by-product of the brewing industry. Anticipating somewhat, we may remark that, this being so, breweries could economically manufacture dry ice for the refrigeration of their delivery vans. The gas could be collected and freed from any smell of fermentation without difficulty. It would then remain to liquefy it (by one of various methods which we need not discuss), and afterwards to convert it into a solid.

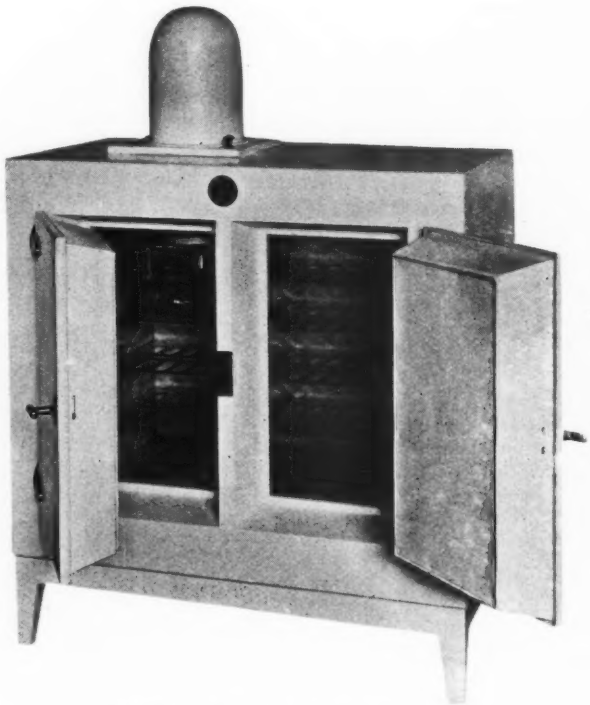
In the best-known process of solidifying liquid CO_2 the liquid is adiabatically expanded, through a nozzle, to about atmospheric pressure, the result being that such of the liquid as does not evaporate (about one-third of its weight), is frozen into dry CO_2 snow. The evaporated gas is, of course, collected and reliquefied. The snow is then taken to a hydraulic press, where it is compressed, at from 50 to 100 atmospheres, into a hard block, the specific gravity of which is no more than 1·2 at most, and probably a little lower.

Apart from the fact that the solid thus produced has a specific gravity so relatively low, the process has other obvious disadvantages, the chief of them being:

(*a*) The double nature of the operation; (*b*) the necessity of expending considerable power in compression; (*c*) loss of "coldness" in transferring the snow to the press; (*d*) further neutralisation of coldness by the generation of heat in compression.

The "Carba" patented process, invented some three years ago by Eichmann and Ruefener, two Swiss engineers, is unquestionably a great improvement on that just described, in that all the foregoing disadvantages are eliminated.

Essentially, this process consists in the adiabatic expansion of liquid CO_2, through a needle valve, a nozzle and diffuser of special design, to the triple point pressure of 5·28 atmos. abs., whereby the freezing-point of CO_2 is reached (ttr. = 56·65° C.). There is thus produced, not a dry, but a moist CO_2 snow—an intimate mixture of liquid and crystals, which gradually accumulates upon a filter at the base of a vertical generator. The size of the block of dry ice is controlled by timing the operation. When sufficient snow has been formed the generator is opened up to atmospheric pressure. This decrease in pressure from 5·28 atmos. to 1 (abs.) causes the temperature to drop to about −80° C., while part of the liquid in the moist mass evaporates, abstracting, by its latent heat of vaporisation, heat from the remainder. This is thereby frozen, and the whole



A "Carba" Household Refrigerator.

mass is converted into a hard, solid block, with the high specific gravity of 1·4 to 1·5.

The re-evaporated gas diffuses through the block, passes through the filter, and so to the low pressure cylinder of the main liquefying compressor, by which it is re-liquefied and returned to the process.

When the manufacture of the block has been completed the lower cover of the generator is opened, and the block slides out. Blocks of any size up to 8 ft. by 10 ins. can be produced, and the section may be either round or square. The blocks can readily be reduced to pieces of any required size by means of an ordinary saw.

Comparison with Water Ice.

A careful theoretical comparison of the efficiency of dry ice and water ice (including a mixture of the latter with salt) is not possible within the limits of a short article. It is, however, a fact easily capable of proof that the relative efficiency of dry ice, which at zero C. is about twice that of water ice, increases as the working temperature is lowered, and that, owing to the fact that actual working conditions affect the two refrigerants to very different extents, the theoretical superiority of dry ice becomes, in practice, still more pronounced.

Briefly, the practical efficiency of dry ice, which varies with the conditions, is from about five to about fourteen times greater than that of water ice (or ice and salt). In support of this statement it must suffice to adduce two actual illustrations.

1. Dry ice cabinets of the household refrigerator type—*e.g.*, the "Carbofrigor"—are now being used on the Continent, the working temperature being about 2° C. These cabinets require 10 kgs. of dry ice every 10 days. An ice-box of similar size would require about 15 kgs. of water ice every two days. Therefore, the efficiency of the dry refrigerant is seven and a half times that of the wet.

2. It is stated by Taylor (U.S.A. Official Reports), that in the transport of a consignment of fish from New York to Detroit, a journey of about 700 miles, the amount of dry ice required was 1,430 lbs., the temperature maintained being from −15° to −20° C. The amount of water ice required was 4 tons *plus* 8 cwt. of salt *twice*, the original load having to be renewed about halfway through the journey. Therefore, under these conditions, the efficiency of dry ice was twelve and a half times that of water ice and salt.

So much for the comparative efficiency of the refrigerants. As for their relative merits on counts other than that of refrigerating efficiency, let us consider the following obvious, but important, facts:

(*a*) The atmosphere produced by dry ice is dry and antiseptic. That produced by water ice is neither.

(*b*) The "dead space" occupied by dry ice is less, in any conditions, than that occupied by water ice, thus allowing greater storage space.

(*c*) In the case of cabinet conservators the use of dry ice makes for lightness and mobility.

(*d*) Packing, whether of cabinets or refrigerator vans, is done more quickly, thereby effecting economy.

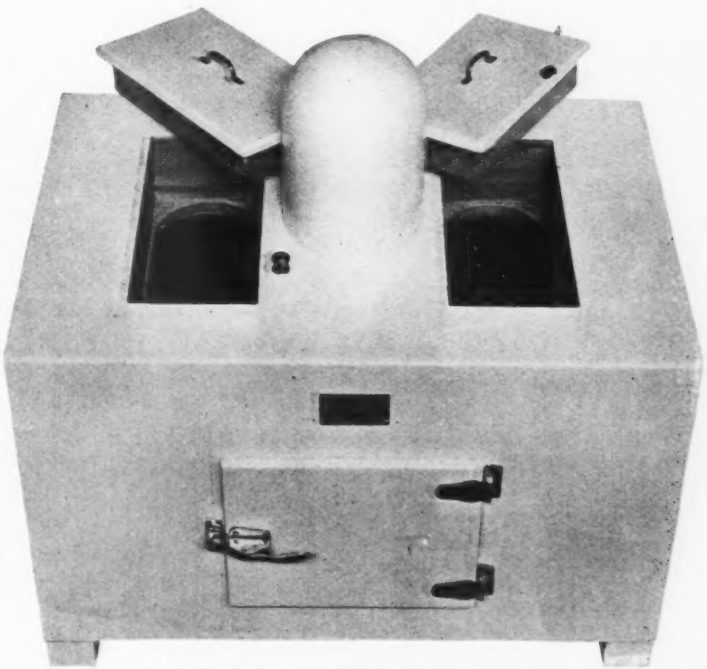
(*e*) In transport of large quantities of perishable goods refrigerated by water ice and salt every ton of material bears freight on half a ton of refrigerant: in the case of dry ice, on half a hundredweight.

(*f*) With dry ice goods could be carried over any journey in Great Britain on a single charge. With water ice provision would sometimes have to be made for "re-icing."

(*g*) The damage caused by dry ice to railway trucks, etc., is *nil;* that by water ice, as is well known, is very considerable.

(*h*) In vans refrigerated by water ice a considerable amount of the available storage space must be left vacant, so as to allow free circulation of the air. With dry ice, the more completely a van is filled, the better.

In addition to the foregoing advantages, and to those deducible therefrom, which dry ice is clearly seen to possess, others might easily be mentioned. Enough, however, has been said to show that dry ice is, in every respect, a far more satisfactory refrigerant than water ice. The important question now arises, is it proportionately as cheap?



The "Carbofrigor" Cabinet for the Conservation of Ice-cream both in Bulk and in Brick Form.

So far as this country is concerned this question cannot yet be definitely answered, since the commodity has still to be marketed here. One may, however, say this: that there is no reason why it should not be sold at a price which, regarded only from the standpoint of relative efficiency, would be about proportionate to that at which ordinary ice is sold. At any rate, it is competing with the latter on the Continent. Our manufacturers may be relied upon to see that it does so here: for, otherwise, they will merely be wasting both their time and their money.

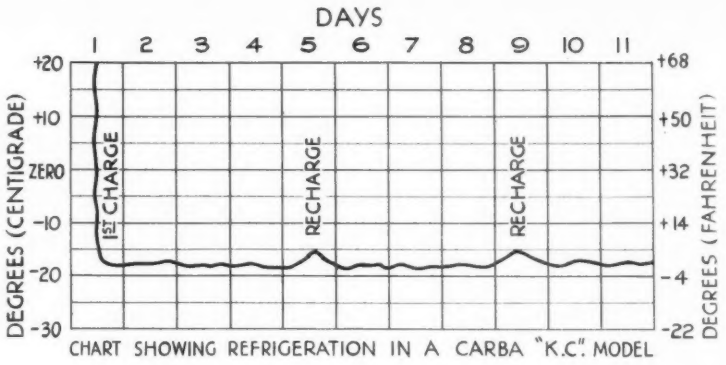


CHART SHOWING REFRIGERATION IN A CARBA "K.C." MODEL

Uses.

Dry ice may be used for the conservation of any perishable food, manufactured or otherwise, with the possible exception of certain of the more delicate fruits, like peaches. Experiments made with dry ice and these delicate fruits are not yet conclusive.

For the conservation of such products as ice-cream, whether in bulk or in packet, butter, milk, cream, fish, fresh meat, game, etc., dry ice is particularly suitable. Cabinets, similar to those illustrated, are available for the storage of such commodities on a small scale; railway vans refrigerated with dry ice are even now being used for their transport in quantity, and experiments are being made with a view to utilising dry ice for the refrigeration of motor vans.

The design of the cabinets referred to is eminently simple. Since there are no moving parts the possibility of anything going wrong does not exist. As for the problem of controlling the rate of dry ice sublimation, and, therefore, of regulating the temperature, this has, admittedly, presented some considerable difficulty. However, by the Carba Co., at least, it has been successfully overcome. The dome-like device, as shown in the illustrations, is a detachable thermos flask. This covers the whole surface of the dry ice except the base. To this the more or less warm air in the cabinet can only gain access through the low temperature compartment situated immediately below the dry ice block, and the extent of the aperture leading into this compartment is controllable by a slide. Thus, within certain desirable limits, the temperature inside the cabinet can be regulated, since the rate at which the refrigerant vaporises depends upon the extent to which the slide is opened to admit the air.

The refrigeration obtainable in one of the Carba models is shown below. The weight of the dry ice block normally used in such cabinets is about 22 lbs.

When the temperature required is higher, the dry ice lasts longer, of course.

The manufacturer of ice-cream will be interested to learn that dry ice can be used, not only for the conservation of his product in brick form or in bulk, but for the freezing of the mix itself. A machine is now being designed to effect this purpose. A predetermined quantity of solid CO_2 will be placed directly in the mix, which will be whipped up automatically. The dry ice will absorb the latent heat from the mix, thereby freezing it, and, evaporating into gas, will disappear. The whole process will take not more than about five minutes. Needless to say, the CO_2 will have no adverse effect whatever upon the quality of the ice-cream. On the contrary, the speed of the operation will tend to improve it.

In railway refrigerator vans the dry ice is placed in insulated boxes at the ends of the van, near the roof. The vans are themselves well insulated, and their doors are hermetically closed. A fan driven from the lighting batteries of the van is controlled by a thermostat, so that, should the temperature rise beyond the admissible limit, the CO_2 gas near the roof is drawn off, passed through the dry ice boxes, cooled, and returned to the body of the van. As already mentioned, the displacement of atmospheric oxygen is advantageous, and, with fat fish, prevents oxidation of the fatty matter.

It may be worth mentioning that small packages of perishable foodstuffs—samples, for instance—could easily be sent by post if dry ice were used as the refrigerant. It would merely be necessary to enclose a small piece of the refrigerant in the package, and wrap the latter in some stout cardboard or similar thick material. The contents, no matter how perishable, would then keep for hours.

Delivery.

Ordinarily, dry ice is delivered by vans, like water ice. When sent long distances by rail, however, light wooden cases are used, in which, as they are well insulated, the loss by evaporation is no more than about 5 per cent. in twenty-four hours. This is partly due to the fact that the cold gas generated itself acts as an insulator, thereby protecting the block from full atmospheric action. Comparatively small quantities of the refrigerant only need packing in cardboard boxes insulated by slag wool or the like, when they can be sent by post.

It will be unnecessary to remark, in conclusion, that it has not been possible to do more, within the limits of this article, than touch the fringe of this interesting subject. Moreover, since dry ice is not, as yet, marketed in this country, certain explicit information which the writer would like to have given has had to be withheld. In the circumstances, however, this was quite unavoidable.

Cacao Shell

A Review of its Uses, Especially as an Economical Accessory Fodder.

By. A. W. KNAPP, M.Sc., F.I.C.

From time to time, attempts have been made to find a more profitable use for cacao shell—now the one by-product of the cocoa works. The author reviews these, and discusses in detail its application as a fodder.

NOW THAT cacao butter is no longer a mere by-product of cocoa manufacture, but is the most valued necessity in chocolate making, there is, apart from factory sweepings, only one by-product of the cocoa works—*i.e.*, cacao shell. Considering all the progress which has been made in the last thirty years in cocoa and chocolate manufacture, it is curious that a more profitable use for cacao shell has not yet been found. It would be an error, however, to assume that efforts have not been made to find one. When finally some ingenious person, who will almost certainly be a chemist, finds a use which raises the value of cacao shell above £5 to £7 a ton, his achievement will be appreciated by all those who have tackled this problem.

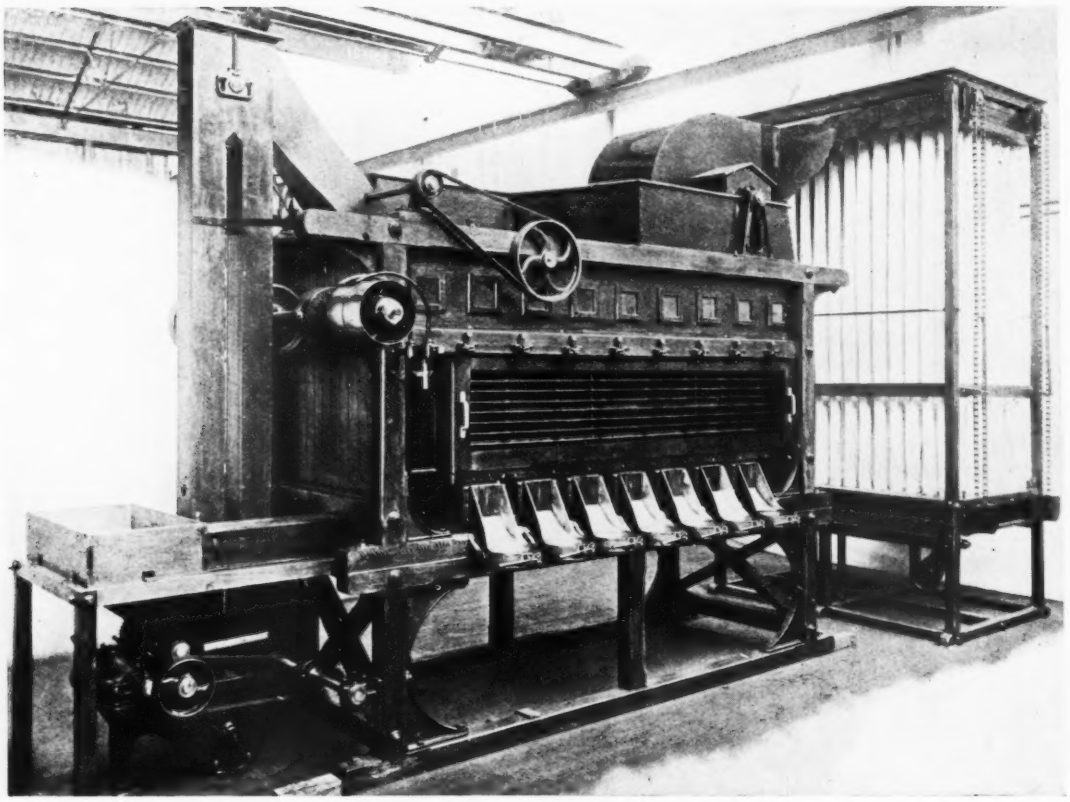
Various Uses Suggested.

There are two uses which are presumably profitable, but which are not recommended: (1) In the production of a confection resembling chocolate by replacing cacao nib by more or less cacao shell and adding some cheap cacao butter substitute to make up for the deficiency in cacao butter. This gives a confection which is not likely to be confused with chocolate by people with discriminating palates. (2) The other profitable use is to grind the cacao shell very finely, mix it with cocoa powder, and sell the mixture as cocoa. It will be twenty years next December since a very important case was tried in which the vendor was prosecuted for selling "pure cocoa powder" containing about 18 per cent. of shell. The case was dismissed mainly on the ground that the shell natural to the cacao bean might reasonably be expected to be present in its products. As various types of cacao bean have from 8 to 15 per cent. of cacao-shell, it is clear that, on pressing out the butter from the whole bean to produce cocoa, the shell will easily reach 18 per cent. in the residual cacao bean material. To-day, however, it is the usual practice of the majority of cocoa manufacturers to remove the shell as completely as mechanical means allow, and generally with modern kibbling machines the amount of shell left in cacao nib is not greater than 1 or 2 per cent. That this has for some time been recognised as good commercial practice was shown in 1918, when the Food Controller introduced regulations which forbade the manufacture of cocoa powder containing more than 5 per cent. of shell. For certain reasons, one of which was the difficulty of accurately estimating small amounts of shell, the regulation was rescinded a few years later.

The principal use of cacao shell is as an ingredient in cattle foods. Before looking at this we will consider its nature and composition and the possible uses that arise out of this. Cacao shell is the skin (testa) of the cacao bean. It is a dry, crisp, brown husk with a pleasant odour resembling chocolate. Commercial samples always contain a little cacao nib, but here we will consider the composition of the pure shell. Its nitrogen content is fairly high, usually about 3 per cent. The whole of this is not derived from protein, as cacao shell contains from 1 to 1·5 per cent. of theobromine and a trace of caffeine. It contains about 3 per cent. of a fat which resembles cacao butter. It gives about 8 per cent. of ash, which is exceptionally rich in phosphates and potash. It contains 16 to 18 per cent. of fibre and some 7 to 10 per cent. of pentosans.

About 20 per cent. of the shell is soluble in water,

Cacao Shell: Showing Customary Packing for Sale.
(By courtesy of Messrs. Cadbury Bros., Ltd.)



Shell Separating Machine.

(By courtesy of Messrs. J. Baker & Sons, Ltd.)

and quantities of cacao shell have been sold in Ireland for many years for the preparation of a drink by boiling with water. During the war it was sold in England for the same purpose at retail prices up to 2s. per lb.! There appears, however, beyond the Irish demand, to be only a very small market for cacao shell tea in normal times.

From its composition one would think the most profitable method of dealing with cacao shell would be: (1) To extract the fat; (2) to extract the theobromine and caffeine; and (3) to ash the residue and use it as manure.

(1) Cacao shell fat when refined obtains a relatively high price.

(2) It is to be regretted that theobromine is not more frequently prescribed in place of caffeine, as it has certain advantages as a medicine over this valuable drug. Theobromine at present is about 8s. per lb., and, as cocoa and cocoa products are its only commercial source, any increase in consumption would react on the price of cacao shell.

(3) As the ash contains about 10 per cent. of phosphoric acid and 20 per cent. of potash, its value as a manure should be appreciable.

(Cacao shell itself has been used as a manure, but to be effective it is necessary that it should first be decomposed by placing in heaps in a wet condition).

The use of cacao shell has been explored in various directions. For example, it has been suggested that a concentrated water extract makes an excellent coffee substitute. It has also been used as a packing material, for explosives filling, and some years ago its use as a source of power alcohol was carefully tested.[1]

Cacao Shell as a Fodder.

As far as the writer knows, the great bulk of 5,000 tons of cacao shell produced per annum in Great Britain has in the past been used as an ingredient in the preparation of cattle cake. This practice has been followed for many years and has given general satisfaction. Though good for cattle, pigs, and sheep, it is too mucilaginous for horses. During the war, when fodder was scarce, cacao shell was given neat, with varying success. This method of feeding cacao shell is not to be recommended. Cacao shell differs from all other fodders in containing a valuable stimulator, theobromine (which resembles the caffeine in tea and coffee). This makes cacao shell valuable in relatively small quantities and toxic in large quantities. The correct place for cacao shell in a dietary is as a stimulator and appetiser. Like all such accessory foodstuffs, it can be taken in excess, a fact which has from time to time been overlooked. This may have been in the minds

of those who drew up the Fertilisers and Feeding Stuffs Act (1927). In this Act, the presence of "husks, chaff, glumes, shudes, hulls, nutshells, or skins of nuts" in a feeding stuff must be declared, and no exception was made in the case of cacao shell. Presumably, cacao shell in a fodder must be declared, although it can be present in cocoa or chocolate for human consumption without declaration, and is, as we have already mentioned, regularly used for the preparation of a beverage in Ireland.

It is well-known that cacao shell has proved a useful ingredient of cattle cake for many years, and a number of scientific feeding tests have been carried out which show it to be, in suitable quantities, an excellent fodder. The good results obtained in the early feeding tests of (1) Professor Maerker,[2] (2) the Popplesdorf Agricultural Experimental Station,[3] and (3) F. Albert,[4] have been confirmed by Professor Ferruccio Faelli in Turin.[5] In the United States, H. H. Dean,[6] as a result of his experiments at the Ontario Agricultural College, suggested the employment of cacao shell in the preparation of a substitute skim milk for calves, and Lindsey and Smith in the *Massachusetts Agricultural Experimental Station Bulletin*[7] show that 1 to 3 lbs. of cacao shell mixed with grain can be fed daily to dairy animals. In England, at the Harper Adams Agricultural College[8] in 1921, a preliminary test covering about ten weeks was made, in which the effect was tried of replacing 2 lbs. of palm kernel meal by 2½ lbs. of cacao shell. The general health of the cows was good and the coats were in good condition. The milk yield appeared to be slightly less, whilst the butter fat was increased. These results require confirmation. Similar results were previously obtained by M. Lucas, and later, on cocoa meal, in 1924, by H. B. Ellenberger and J. A. Newlander.[9] On the other hand, Professor Faelli obtained an increase both of milk yield and cream content.

Vezzani, of Turin, has carried out a number of successful experiments with cacao shell as a feed for pigs.[10] As a result of this test he recommends that it be mixed with other foods in proportions not exceeding 5 to 6 per cent.

These tests all go to show that cacao shell in reasonable quantities is a sound and safe accessory fodder. Whilst the value of cacao shell as a fodder is due partly to its distinctive properties, it may be of interest to note how it has been valued strictly as a food. Various authorities state that it is—equal to straw (Kellner), between hay and wheaten bran (Maerker), worth half-price of maize meal (Lindsey and Smith), 2 lbs. of cacao shell equal 1½ lbs. of grain (M. Lucas). From these valuations and from A. Smetham's estimation[11] of the food units present—viz. 102 to 104—cacao shell is a very economical accessory fodder at £5 a ton. Whilst E. T. Halnan, in the *Journal of the Ministry of Agriculture*[12] (1925), quotes 2 to 6 lbs. per day as giving useful results with cows and up to 10 lbs. as giving favourable results, it appears to the writer that the quantity fed to a cow should not exceed 2 to 3 lbs. per day, and that the best use of cacao shell is as an ingredient in cattle food. Cattle appear to acquire a taste for it, a fact which should appeal to cattle cake makers.

It is to be feared that the first effect of the Fertilisers and Feeding Stuffs Act in classifying cacao shell with such materials as rice shudes and nutshells has discouraged its use. As the most satisfactory and important use of cacao shell is as an appetising ingredient of cattle cake, one hopes that the cattle cake manufacturers will not be permanently discouraged by this classification, but will continue to use cacao shell and *advertise that they use it*.

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Calculation of Formulae of Ice-Cream Mixes

By ERIC L. E. HUMPHRISS, F.R.M.S.

The author describes a method of calculating the proportions of the ingredients required to produce, on compounding, an ice-cream mix of a certain composition. By this means the manufacturer is able to vary his mix analysis as circumstances may dictate, and he is also able to compound a mix of any weight to a given percentage composition, utilising any surplus ingredients he may have on hand.

GENUINE ICE-CREAM may be regarded as being compounded essentially of milk, fortified as regards its fat content by the addition of a milk-fat concentrate; plus for an analogous reason a milk-solids-not-fat concentrate, the whole sweetened with sugar and stabilised by the incorporation of a fractional percentage of gelatin.

Viewed thus, the calculation of a formula for the compounding of an ice-cream mix of any given analytical composition simply amounts to this: By what means can the requisite proportions of the various ingredients summarised above be determined, so as to give, when compounded together, a mix of the desired analytical composition? Various rules and tables are in use to attain this end; none, however, to the writer's knowledge are as simple and comprehensive as the algebraic method outlined below. Mathematically this method depends on the well-known algebraic manipulation—the solution of simultaneous equations—and can be applied to the calculation of formulæ involving any combination of dairy products whatsoever.

To digress for a moment in the interests of clarity, it may be said that the usual butter-fat concentrates used are either butter (fresh) or cream, whilst the serum solids concentrate may be skim milk powder, condensed whole or skim, sweetened or unsweetened milk. Powdered whole milk is rarely used and can be regarded as a fat-cum-M.S.N.F. concentrate. Mixes are, of course, not infrequently made without the use of milk; for instance, a mix of any analytical composition could be prepared from butter, skim milk powder, sugar, gelatin, and water. A mix in which such ingredients were utilised could be calculated quite easily by simple arithmetic, and hence will not be considered herein.

On a moment's reflection it will be obvious that in considering the analytical composition of a mix we have three variables, each of which is influenced by each dairy constituent of the mix—namely, the fat content, milk-solids-not-fat content, and the total solids content (and in inverse ratio to the last-named, and, therefore, dependent on it—the water content). The method therefore adopted is to equate the percentages of these various substances in the ingredients with the desired percentage of the same substance in the mix. This will doubtless be clearer if an illustration is given. We will postulate as the required percentage composition of the ice-cream mix:

Fat	10	per cent.
M.S.N.F. ...	10	,,
Sucrose	13·50	,,
Gelatin	00·50	,,
Total solids ...	34·00	,,

Assume our available ingredients to be as follows:

Milk:

Fat	3·50	per cent.
M.S.N.F. ...	8·70	,,

Cream:

Fat	50·00	,,
M.S.N.F. ...	4·50	,,

Skim milk powder:

Fat	—	(see concluding note)
M.S.N.F. ...	100	per cent.

Then, regarding the desired percentage composition postulated above (for the mix) as representing the weights of the various substances in 100 lbs. of mix and letting:

a = wt. in lbs. of milk required in 100 lbs. mix,
b = wt. in lbs. of cream required in 100 lbs. mix,
c = wt. in lbs. of skim milk powder required in 100 lbs. mix,

we can write the following equations:

$$a + b + c = 86 \quad \text{.....(1)}$$

$$\frac{3{\cdot}5a}{100} + \frac{50b}{100} - = 10 \quad \text{.....(2)}$$

$$\frac{8{\cdot}7a}{100} + \frac{4{\cdot}5b}{100} + c = 10 \quad \text{.....(3)}$$

N.B.—1 = Everything but gelatin and sugar.
2 = Butter-fat.
3 = M.S.N.F.

Multiplying throughout by 100 to eliminate fractions we get:

$$100a + 100b + 100c = 8{,}600 \quad \text{.....(1)}$$
$$3{\cdot}5a + 50b + -- = 1{,}000 \quad \text{.....(2)}$$
$$8{\cdot}7a + 4{\cdot}5b + 100c = 1{,}000 \quad \text{.....(3)}$$

Adopting the ordinary method of solution of simultaneous equations we see that by subtracting (3) from (1) we eliminate c:

$$100a + 100b + 100c = 8{,}600 \quad \text{.....(1)}$$
$$8{\cdot}7a + 4{\cdot}5b + 100c = 1{,}000 \quad \text{.....(3)}$$
$$91{\cdot}3a \quad 95{\cdot}5b \quad - = 7{,}600 \quad \text{.....(4)}$$

Also by multiplying (2) by 1·91 and subtracting the product from (4) we can eliminate b:

$$91{\cdot}3a + 95{\cdot}5b = 7{,}600 \quad \ldots\ldots(4)$$
$$6{\cdot}685a + 95{\cdot}5b = 1{,}910 \quad \ldots\ldots(5)$$
$$84{\cdot}615a - = 5{,}690 \quad \ldots\ldots(6)$$
$$84{\cdot}615a = 5{,}690$$
$$a = 67{\cdot}245 \text{ lb.}$$

Now by substituting in (2) the newly found value for a, we calculate b as equal to 15·292 and by a similar substitution in (1) of the values for a and b we find c equals 3·463 lb. Our formula thus becomes:

Milk	67·245 lbs.
Cream (50 per cent.)	15·292 ,,
Skim milk powder	3·463 ,,
Sucrose	13·500 ,,
Gelatin	00·500 ,,
Mix weight	100·000 ,,

From this 100 lbs. mix formula, by simple proportion, a mix of any weight can be easily computed. Checked up theoretically, this formula gives an analysis of:

Fat	10 per cent.
M.S.N.F.	10 ,,
Sucrose	13·5 ,,
Gelatin	00·5 ,,
Total solids	34·00 ,,

which is the percentage composition desired. Exactly the same mathematical mechanism holds if any other per cent. cream is used, or if fresh butter is employed as the butter-fat concentrate; also, if instead of skim milk powder, condensed, unsweetened, skim or whole milk, for example, is used as the source of extra M.S.N.F. In each case, of course, the appropriate alterations are made in the primary equations (1), (2), and (3), depending on the analytical data of the ingredients used. It will be obvious also that identical algebraic processes hold for any other postulated percentage mix composition, the necessary adjustments again naturally being made in the numerical co-efficients of the equations.

When a concentrate is used which contains sugar a slightly different equation is necessary. This alteration is occasioned because the quantity of cane sugar to be added, over and above that contained in the sweetened concentrate, is itself an unknown, depending on the undetermined weight of such sweetened concentrate added. We cannot, therefore, deduce what the total weight of dairy products must equal prior to the solution of the equations, and we cannot, therefore, construct an equation parallel to equation (1) in the previous example. The difficulty is, however, overcome by utilising the water content of the mix as the third constant, and constructing the equation thereon.

As in the former case, a worked example will probably be the most eloquent exponent of the notion. Postulating, then, a desired percentage composition of the mix as:

Fat	8 per cent.
M.S.N.F.	10 ,,
Sucrose	13·5 ,,
Gelatin	00·5 ,,

and using *milk* and *cream* of composition as before, and, in addition, say:

Sweetened whole milk, Testing:

Fat	10 per cent.
M.S.N.F.	26 ,,
Sucrose	37·85 ,,
Total solids	73·85 ,,

and letting:

a = wt. of milk in 100 lbs. mix.
b = wt. of cream in 100 lbs. mix.
c = wt. of above condensed product in 100 lbs. of mix.

We can write the following primary equations:

$$\frac{3{\cdot}5a}{100} + \frac{50b}{100} + \frac{10c}{100} = 8 \quad \ldots\ldots(1)$$
$$\frac{8{\cdot}7a}{100} + \frac{4{\cdot}5b}{100} + \frac{26c}{100} = 10 \quad \ldots\ldots(2)$$
$$\frac{87{\cdot}8a}{100} + \frac{45{\cdot}5b}{100} + \frac{26{\cdot}15c}{100} = 68 \quad \ldots\ldots(3)$$

N.B.—1 = Butter-fat.
2 = Milk solids—not fat.
3 = Water in mix equated to its sources.

Eliminating fractions as before (x 100):

$$3{\cdot}5a + 50b + 10c = 800 \quad \ldots\ldots(1)$$
$$8{\cdot}7a + 4{\cdot}5b + 26c = 1{,}000 \quad \ldots\ldots(2)$$
$$87{\cdot}8a + 45{\cdot}5b + 26{\cdot}15c = 6{,}800 \quad \ldots\ldots(3)$$

By multiplying (1) by 2·6 and subsequent subtraction of (2) from the product we have:

$$9{\cdot}1a + 130b + 26c = 2{,}080 \quad \ldots\ldots(4)$$
$$8{\cdot}7a + 4{\cdot}5b + 26c = 1{,}000 \quad \ldots\ldots(2)$$
$$0{\cdot}4a + 125{\cdot}5b - = 1{,}080 \quad \ldots\ldots(5)$$

Again, by multiplying (2) by 1·006 and subtracting it from (3) we get:

$$87{\cdot}8a + 45{\cdot}5b + 26{\cdot}15c = 6{,}800 \quad \ldots\ldots(3)$$
$$8{\cdot}7522a + 4{\cdot}527b + 26{\cdot}15c = 1{,}006 \quad \ldots\ldots(5)$$
$$79{\cdot}0478a + 40{\cdot}973b - = 5{,}794 \quad \ldots\ldots(7)$$

And, finally, by multiplying (7) by 3·063 and subtracting therefrom (5) we obtain an equation containing only one unknown, which we can therefore directly solve:

$$242{\cdot}1234a - 125{\cdot}5b = 17{,}747{\cdot}022$$
$$000{\cdot}4000a - 125{\cdot}5b = 1{,}080{\cdot}000$$
$$241{\cdot}7234a - = 16{,}667{\cdot}022$$
$$241{\cdot}7234a = 16{,}667{\cdot}022$$
$$a = 68{\cdot}95 \text{ lbs.}$$

By substituting in (5) we find b = 8·39 lbs. and a similar evaluation indicates c = 13·92 lbs.

We find (by calculating 37·85 per cent. of c and subtracting the result from 13·50) the additional sugar to be added is 8·23 lbs. Our mix formula now becomes:

(*Continued on page 332.*)

The Fourth Annual Convention of the National Food Canning Council at Leicester and Lowestoft, 1930

At Leicester, from October 24 to 30, a highly successful Canners' and Allied Trades' Exhibition was held at the Granby Halls, the chief feature being a remarkable display of canning machinery and equipment of British manufacture. Several important conferences were held, and these are reported below. The Convention then moved to Lowestoft, where a Conference relating to fish canning was held. Here they were most hospitably entertained by Messrs. Co-operative Wholesale Society, Ltd.

During the above proceedings frequent reference was made to magnificent work being carried out by Sir Edgar Jones, Chairman of the Council, and also by F. Hirst and W. B. Adam, at the Campden Research Station, by T. N. Morris, J. M. Bryan, and others at Cambridge, and by G. T. Atkinson, of the Ministry of Agriculture and Fisheries.

Conference on Canners' Problems

A conference on Canners' Problems was opened by A. Ll. Matthison, E. H. Bell, and W. J. Foley at the Granby Halls, Leicester, on October 29.

MR. MATTHISON, in the course of an address on the *Lacquer Makers' Contribution to the Success of the Food Canning Industry*, pointed out that faults in lacquered cans are not always attributable to the lacquer maker, but in many instances are due to carelessness on the part of the canner or to his lack of appreciation of the fact that cheapness in lacquers does not constitute economy in the long run. Moreover, the correct treatment of the lacquer—*i.e.*, correct application and stoving—is quite as important as using the right lacquer. The various operations involved in modern mass production impose severe conditions on lacquers, and packers are urged to exercise greater care in charging retorts and in handling and cleaning the cans. There are special lacquers for particular foodstuffs and conditions; thus, the sulphur resisting (or S.R.) lacquer is made especially for foodstuffs with a sulphur content. Again, there are lacquers made, which are used chiefly on the Continent, for application to the outside of the tin over printing and decoration, to do away with the necessity of using a paper label. British packers are rather slow in taking up this labour-saving method and they prefer the old system of labelling. Mr. Matthison advocated the use of the term "*Hygienic Can*" in place of "Sanitary Can."

Mr. E. H. Bell (of the British Can Co., Ltd.) paid a tribute to *British high-grade canning* and to the conscientious, scientific way in which problems are being tackled. He felt certain of a phenomenal growth in the British canning industry during the next few years. He was convinced that quality should be the primary consideration of the canning industry. Mr. Bell advocated the leasing of machinery to canners, but several speakers said they preferred to be independent and purchase in accordance with their own judgment.

Mr. Foley (U.S.A.) said that the *research chemist* had contributed largely to the success of the American industry. The three most important points in canning were: (1) Proper closure, (2) safe time and temperature of sterilisation, and (3) proper cooling. He advised making a cross-section of the seam for examination every two hours; also, thorough cleaning by steam at noon and night of machinery and equipment.

In the course of the general discussion, Sir Edgar Jones expressed a hope that the question of direct printing *versus* labelling would be thrashed out. Mr. Scott compared British with American conditions and doubted the desirability of the system of renting machinery. In reply to questions, Mr. Matthison explained that *lacquers* must conform to food regulations, and that they did not contain lead or any other substances detrimental to health. Lacquers were made from fossil gums, linseed oil and turpentine, and one could actually consume lacquers without danger. Messrs. Cox, Thomas, Black, Matthison, and others expressed views on the question of the French practice of *direct printing on cans* in place of labelling. In this country it does not appear to

Members of the Convention Photographed outside the Co-operative Wholesale Society's Factory at Lowestoft.

have gone beyond the stage of experiment, and there is an obvious lack of definite data. The British public and packer are accustomed to glossy, highly coloured labels, and it is questionable whether lacquers and printing inks have yet been developed which will stand up unimpaired to retorting. In fact, the German housewife is said to judge the efficiency of sterilisation by the degree of glossiness. Retorting has a tendency, in the case of whites, to produce broken whites. The general effect of retorting on direct printing is to produce a " second-hand " appearance. Mr. Black pointed out that yellows discolour in steam, and that the comparative effects of water and steam on gloss and colour were worthy of investigation.

The vexed question of the *de-greasing of cans* came up for discussion. Should this be carried out at the tinplate works, at the can makers' works, or in the canning factory? The presence of traces of grease on tinplate immediately previous to lacquering was detrimental to the permanence of the lacquer, and resulted in peeling and shelling, for example. The general opinion appeared to be that the removal of grease should immediately precede lacquering, since if it were done at any time previous to this there is great probability of the work being undone by further soiling due to handling, etc.

C. W. Banks discussed the problem of *deep-drawing* and its effect on tinplate and lacquer. There is, of course, a limit to the ductility of tin and the elasticity of lacquer; but, as pointed out by Sir Edgar Jones and Mr. Matthison, remarkable progress is being made in the practice of deep-drawing, and noteworthy results have recently been achieved. Here, again, care should be taken to secure the right kind of tinplate or lacquer for the special type of work.

Mr. Matthison had stated that *S.R. lacquer* was not suitable for fruit, but only for sulphur-containing foods; Mr. Samson wished to know why this was so. The latter wished to know what would be the position of the canner who was canning fruit which had been sulphured and had probably retained some residual sulphur at the time of canning. Would Mr. Matthison advise the use of a S.R. lacquer on account of the presence of this sulphur? Also, was there any possibility of springers and swells being developed in this case? He was also of the opinion that the troubles of the user of sanitary (hygienic) cans were due to the presence of small *globules of solder* in the cans, and to the *burning of the lacquer* on the side seams.

Some interesting comments were made by the representative of the Paint and Varnish Research Association. He referred to the certainty of research chemists developing, in the near future, *new synthetic gums and resins* which would be vastly more sulphur and acid resisting than any which have hitherto been produced. He did not think it would be a difficult matter to make a lacquer which would adhere rigidly to even greased plates. Finally, he invited co-operation with his Association in research work concerned with lacquers and lacquering.

Joint Conference of Growers and Canners

The keenness of growers was this year in strong evidence. The sense of the meeting seems to forecast considerable extensions of a system of contracts between growers and canners.

Until canners can secure an adequate volume and continuity of fruit in a condition suitable for their purposes, it is useless for them to launch into business on a big scale.

Canners are ready to make contracts of, say, five years with any growers furnishing evidence that a continuity of adequate supplies is assured.

ON October 30 a joint conference with the fruit growers was held at Leicester, in the course of which several points of great interest emerged.

Last season provided plenty of examples of canners unable to obtain adequate *supplies of fruit*. This is a clear indication of the necessity for the mass production of fruits and vegetables suitable in quality and variety for canners, and that this production must be concentrated in areas adjacent to the canneries. The transport of soft fruits is not desirable.

Canners were unable to obtain *black currants*. This was due not so much to the question of price as to the non-availability of currants suitable for canning. It appears that growers have not fully appreciated the fact that they must pick these berries when they are hard and just on the turn and that they must be absolutely dry. If allowed to ripen or to become mushy, or if they are picked wet or allowed to become wet during transport, they are unsuitable for the canner on account of the difficulty of sprigging by machinery.

The question of the *price of loganberries* came up for discussion. Incidentally, statements of a misleading character have appeared in the daily Press. The supply of first-class quality loganberries free from weevil (now rendered possible by the researches of the Ministry of Agriculture) is ridiculously inadequate for the demands of canners. As regards price, big scale production at 3d. per lb. would give the growers a good profit on the large quantities required by canners.

Growers could supply *pears and apples* suitable for canning purposes, but as one would have to wait seven years in one case and fifteen years in the other for any return on capital, this is a clear case where the Government would render incalculable service to the industry by financial assistance, and there would be no difficulty in developing a scheme placed upon a proper business footing.

Fish Canning Conference

A CONFERENCE with representatives of the fishing interests, held at Lowestoft on October 31, was opened by F. Wilkinson, who discussed the difficult question of the *Price of Herrings*. Instability in the price of this commodity imposes a serious handicap on the growth of the fish canning industry. Under present conditions it is largely dependent on the uncertainties of supply and demand and is nothing more than a lottery. Some steadying influence is required (but no constructive suggestions were forthcoming). Regulation (but not necessarily a lowering) of prices would mean greater confidence and continuity of business. Mr. Wilkinson pointed out that 70 per cent. of British herrings are exported, and asked why they are not more popular at home. On the other hand, before the war, one and a quarter million barrels of herrings went to Russia; now this trade is only one-tenth of what it was. The public do not realise that the herring is the most nutritious of fish. They must be more widely informed of its virtues—especially canned herring. Then, again, " Kippers Cure Influenza."

In the course of the subsequent general discussion, one speaker expressed the opinion that an obstacle to more extended consumption of herrings and kippers was *the presence of bones*. The British were a breakfast-eating people, and, unfortunately, for most of us it was the most hurried meal of the day and there was little time for removing troublesome bones. The speaker suggested that if the fish were offered to the public in a de-boned condition, it would be beneficial to the trade.

Mr. Banks pointed out that de-boning operations were readily carried out by machinery. (De-boned bloaters are already on the market). He concurred with Mr. Wilkinson on the desirability of steadying prices, and complained about the *shortage of sprats* for canning. Picklers take most of the sprats, and canners are forced to a substitute of poor quality herrings.

In a remarkably able and inspiring address, Sir Edgar Jones dealt with these and other related problems from a broader and more original point of view—rich in constructive ideas. The substance of Sir Edgar's remarks is as follows:

WE ARE NOT GETTING THE MOST OUT OF FISH.

Generally, it is being wastefully used in a crude and unscientific manner. It is a rich, natural product whose latent values are not being fully realised. In its present state the industry is in a relatively primitive condition. In terms of the meat-packing industry, *it has not advanced beyond the "salted pork in the barrel" stage,* but surely there is not the slightest reason—apart from apathy—why the fish industry should not be as big, prosperous, highly organised, efficient, and as scientific as its fellow industry. In the Chicago packing-house there is no waste;

WHAT HAS BEEN DONE FOR THE PIG CAN BE DONE FOR THE HERRING

—or any other fish—and yet we are still content to go on packing salted herrings in barrels in much the same frame of mind as our grandfathers packed salted pork.

Take another comparison. Just as petroleum and metallic ores are natural products of relatively small value in themselves, but which, as the raw materials for the production of petrol, paraffin, lubricating and other oils, or, in the case of ores, of the various metals, so is fish in its crude, natural state to be regarded as the raw material for a series of specialised products, the preparation of which would surely give rise to a fish-packing industry upon a scale far vaster and more profitable than we find to-day.

Every part of the fish should be turned to profit—the hard and soft roes, offal, scales, skin, bones, oils, special extracts and so on; and then there is the edible bulk of the fish which may be canned in various sauces or otherwise treated in a variety of ways. No doubt hard roes could be packed in appetising sauces and find a ready market abroad. It is obviously a case for *centralised fish-packing factories,* into which the fish are unloaded direct from the boat. All this would be to the good of the catcher of fish (the primary producer). On a small scale this is true to-day. How is it that Germany can afford to buy herrings here and subject them (in Germany) to elaborate pickling processes? Evidently these processing operations render it possible for her to take the great bulk of our herrings—incidentally to the advantage of the primary producer. Then, again, one may note with interest that more than half the fish consumed here goes to the fried-fish shops—and no one would dispute the assertion that this is a profitable business. Yet between ship and shop there is often great waste (though less now than formerly) which might be turned to profit—and here, again, the primary producer would take his share of the ultimate profits.

Sir Edgar concluded with an appeal for the setting up of *an Institute for the Fish Industry*—a general clearing-house for technical information—similar to those in Germany and Norway which have proved themselves of immense help to the industry.

Comparison between Vacuum Closing and the Heat Exhaust Method in the Canning of Fruit

By F. W. HIRST, M.Sc.

Director of University of Bristol Research Station, Campden, Glos.

The following is the substance of a paper read at the Leicester Conference on October 29.

DURING 1929 experiments were carried out at Campden to determine whether the vacuum closing method could be applied with advantage to the canning of fruit. In the normal heat exhaust method the air surrounding the fruit or present in the intercellular spaces is removed to a large extent by heating the cans in an exhaust box at 160° to 200° F. for five to eight minutes. The air is driven out by expansion and to a certain extent possibly by respiration. Then the cans are sealed at generally 140° to 160° F. The higher the temperature during closing, the higher the vacuum in the can after cooling.

In the vacuum method the air is drawn out by suction, and the lid is spun on while the filled can is in the evacuated chamber.

From the practical standpoint it is essential that the complete process of evacuating and seaming should not occupy more than one second. Allowing for the time taken in seaming, the time of evacuating must be much less than one second. In this brief interval the air must be drawn from the fruit to the surface of the can. The lid is spun on at the desired vacuum, this being largely determined by the resistance of the can to collapse.

If the air is removed more efficiently by the vacuum method than by heat exhaust, it is possible that certain very desirable results may be attained. The presence of air inside the closed can is an important factor in hastening the corrosion of the tinplate by the fruit acids, and reduction or elimination of air may diminish the tendency for the cans to perforate or form hydrogen swells. Air is also known to cause destruction of vitamin C—the chief vitamin in fruits and the most susceptible to oxidation—and closing under vacuum may possibly also assist the sterilisation process. Certain colour change brought about during the canning of fruit—such as the alteration in colour of canned strawberries—may be in part due to oxidation of the natural colouring matter by the air left inside the can, and the complete removal of air in this case should improve the colour of the fruit. The elimination of the heat exhaust may also prevent the loss of a certain amount of flavour which escapes during the heating of the contents of the can for some minutes before sealing.

Tests were carried out to investigate these questions, and the following summarises the results obtained:

Experimental Work of 1929.

In order to assist removal of air from the contents of the cans, it is advisable to use a warm syrup, but the temperature must not be high enough to cause "bumping" of the liquid when the vacuum is suddenly applied. The most satisfactory temperature is 120° F., and it is important to have previously boiled the syrup to expel dissolved air.

The vacuum closing machine was set to seal No. A.2 size cans only, and it was found that these could safely be closed at 24 ins. vacuum. Gooseberries and strawberries were evacuated for a period of one to two seconds at 15 ins. vacuum, while raspberries, loganberries, bilberries, blackberries, Pershore plums, Victoria plums, damsons, and apples were evacuated for a similar time at 24 ins. vacuum.

Colour, Flavour, and Texture.

These tests were made on a series of cans which had been sterilised for various lengths of time. Raspberries and loganberries canned by the vacuum process were very slightly paler in colour and had a faint orange tint, the heat exhaust samples being a deeper shade of crimson. Apart from these two cases, there were no detectable differences in colour, flavour, and texture in the fruits compared.

Sterilisation.

The vacuum closed cans were processed for times varying from two to twelve minutes, and the heat exhausted cans from nought to ten minutes. Vacuum closed cans did not appear to be any more easily sterilised than heat exhausted cans. With the latter method it was found that after an exhaust of five minutes at 180° F. a heat treatment of two minutes at boiling point was the minimum time sufficient to prevent decomposition by micro-organisms, whereas with the vacuum closed cans a six-minutes' cook at the same temperature was the minimum, the extra time representing the period of heating given in the exhaust box to the heat exhausted cans.

Vacuum Inside Cans.

The corrosive action of the fruit acids on tinplate is of considerable practical importance when it makes itself evident in the form of hydrogen swells or perforations. When fruit is canned by the ordinary heat exhaust method the air is more or less efficiently displaced, and the cans show a final vacuum which is mainly determined by the temperature of closing, the size of can, and the depth of head-space. A high degree of vacuum in the cans is desirable in that it prolongs the period before the development of hydrogen swells.

It is the general practice when filling the cans to allow a head-space of $\frac{1}{8}$ to $\frac{1}{4}$ in., and No. 2 American size cans closed about 150° to 160° F. generally produce a vacuum of about 10 to 11 ins. in the cans after processing and cooling. Some indication of the value of the vacuum process can be obtained by testing the final vacuum in the can, and experiments at Campden have shown that in the case of fruit covered with syrup at 120° F. a vacuum of 24 ins. has to be applied in order to produce a final vacuum of 10 to 11 ins. Care was taken in these tests to allow a satisfactory head-space, and the cans were closed with a temperature at the centre of about 95° F. The vacuum was applied for one to two seconds.

It was found that the vacuum inside the can dropped very rapidly even before the cans were sterilised, and after cooling the extent of the fall in vacuum was, roughly, from 24 ins. to 10 ins., from 20 ins. to 8 ins., and from 15 ins. to 5 ins. As a matter of interest cans were closed after application of vacuum for a period of thirty seconds, in order to find out whether there was a time factor in the removal of air from the interior of soft fruits, giving final vacua about 1 to 2 ins. higher. It was found, however, that the application of a high vacuum before closing the fruit cans was not sufficient to ensure its retention after sterilisation and cooling.

If vacuum closing alone is to be relied on, it cannot, therefore, be expected to produce final vacua higher than those normally given by a good heat exhaust.

Corrosion.

Cans were filled at 170° F., exhausted for five minutes at 180° F., closed at room pressure, and sterilised for nine to fifteen minutes. All cans in these experiments were then stored at a constant temperature of 72° F., and were examined at frequent intervals for hydrogen swells and perforations. Briefly stated, results showed that the vacuum method does not appear to lessen the tendency towards development of hydrogen swells. With the exception of Victoria plums, cans sealed under vacuum gave a slightly higher percentage of blown cans, but the difference was not very marked, and the losses, apart from loganberries, were not serious.

Other lots of cans were kept in an ordinary store and examined at various intervals. The following figures show the average loss of vacuum inside the cans on storage:

Fruit.	*Method.*	*Vacuum in Cans.* *Stored 1 Week.*	*Stored 12-14 Months.*
Gooseberries ...	Heat exhaust 180° F.	10 ins.	9 ins.
	Vacuum 15 ins.	4½ ins.	3 ins.
Strawberries ...	Heat exhaust 180° F.	11 ins.	7 ins.
	Vacuum 15 ins.	4 ins.	4 ins.
Raspberries ...	Heat exhaust 180° F.	10½ ins.	9 ins.
	Vacuum 24 ins.	12½ ins.	12 ins.
Loganberries ...	Heat exhaust 180° F.	11 ins.	8 ins.
	Vacuum 24 ins.	10 ins.	7 ins.
Black Currants	Heat exhaust 180° F.	9 ins.	7½ ins.
	Vacuum 24 ins.	11 ins.	8 ins.
Pershore Plums	Heat exhaust 180° F.	9 ins.	5 ins.
	Vacuum 24 ins.	9½ ins.	5 ins.
Victoria Plums	Heat exhaust 180° F.	8½ ins.	4½ ins.
	Vacuum 24 ins.	9 ins.	4 ins.
Damsons	Heat exhaust 180° F.	10 ins.	9 ins.
	Vacuum 24 ins.	9 ins.	2 ins.

Each figure represents an average of six to ten cans. Of the other cans examined, some showed a complete loss of vacuum; others gave a slight pressure insufficient to cause doming, and a few were found to have developed into hydrogen swells. These cans were distributed as follows:

	Hydrogen Swells.	*Slight Pressure.*	*No Vacuum.*
Heat Exhaust 180° F.	nil.	2·1%	2·1%
Vacuum 24 ins. ...	2·4%	8·1%	16·2%

From these storage tests it would appear that the vacuum closed cans are rather more likely to develop into hydrogen swells than the cans closed under the heat exhaust method.

The cans have not yet been stored for a sufficiently long period to enable reliable statistical evidence to be accumulated in the experimental batches of cans which are being stored at 72° F., but as far as the evidence goes at the moment it appears that the present heat exhaust method is slightly more efficient than the vacuum process, as it was used on these experiments.

Experimental Work: 1930.

It is possible that the two processes may be combined so as to yield a product which is superior to that given by either method alone.

The chief disadvantage of the vacuum method is that it does not remove the air efficiently from the interior of the fruit; this is shown by the drop of vacuum inside the cans after closing.

The high temperature heat exhaust is satisfactory in so far as it gives a good vacuum (particularly if the contents reach 170° F. before closing), but all the air is not removed. The low temperature exhaust, however, appears to remove the air more efficiently, due to respiratory action of the fruit, but it is not possible by this method to obtain a good vacuum owing to the low temperature of closure.

In the 1930 experiments the two methods—low temperature exhaust to remove air by respiration, followed by vacuum closing—have been combined, and the cans will be stored under vigorous temperature conditions and compared with controls canned by the high temperature heat exhaust method alone.

The vacuum closing machine has also been used for the canning of peas and new potatoes, without liquid. The results were not as satisfactory as the normal packs.

Conclusions.

As regards flavour, texture, and colour, vacuum closing is quite as satisfactory as the normal heat exhaust method. It is doubtful, however, if the use of the vacuum process alone yields as good results as the standard process from the point of view of corrosion, but it is quite possible that the two methods may be used to advantage when combined. The 1930 tests should indicate whether or not this is the case.

The 1929 tests were held at a constant temperature of 72° F., representing the warmest storage conditions experienced in this country, but the results obtained have not yet reached a stage when any very definite statement can be made on the subject.

The experiments carried out during the present season will be more severe as regards storage conditions, the tempera-

ture of storage being 95° F.—a test to determine the capability of the cans to withstand shipment to tropical countries.

If the combined heat exhaust and vacuum methods yield a more satisfactory product than the normal process, this should be of great assistance in the development of export trade in canned English fruits.

It must be remembered that the vacuum closing machine may be more economical in that an exhaust box would not be necessary, and this would also mean a saving in coal. On the other hand, a vacuum closing machine costs rather more than an ordinary closing machine, and it would probably be necessary to instal a separate machine for each size of can.

Prevention of Corrosion Losses

By T. N. MORRIS, M.A. (Cantab.),
of the Low Temperature Research Station, Cambridge.

PERHAPS some of you will remember that when the Convention was held at Cambridge last year I dealt with some of the factors influencing the rate of corrosion of iron, tin, and tinplate.

I was able to show you then that within the range of acidities found in canned fruits the tin was removed from tinplate much more rapidly in solutions of low acidity than in those of high acidity.

This appeared significant in view of the fact that fruits of low acidity such as cherries and bilberries give rise to a high percentage of corrosion losses in canning, whereas more acid fruits like gooseberries, red currants, or even raspberries, suffer comparatively little.

It seemed the natural thing, therefore, to try the effect of adding a small quantity of citric acid (5 to 8 ozs. per 10 galls. of syrup) to the syrup in canning various fruits of low acidity, and I am glad to be able to say that the results were even better than could have been hoped.

With cans stored over a period of nearly a year at 77° F., where acid was added the number of hydrogen swells was negligible; where no acid was added the losses amounted in some cases to over 80 per cent. of the pack.

Similar results have been published during this year by Mr. Hirst at Chipping Campden and by Dr. E. F. Kohman in America.

You may look upon it as a fact established by the results of more than three years' work at Cambridge and by independent work in other places, that the addition of acid in canning fruits which normally give trouble is one of the most satisfactory ways of checking corrosion losses.

In addition to this, the acid improves the colour and flavour of the products and assists sterilisation, and I strongly advise canners to add it to fruits of low acidity, especially if they intend to send their products abroad, or if they are engaged in canning in the warmer parts of the British Empire.

This I think, then, is the most useful way of preventing corrosion losses, but there are one or two others which I should just like to mention.

First, there is cool storage of the cans, which was strongly advocated by Kohman in 1924. It would, of course, be out of the question in this country, at present, to keep canned goods in cold storage, but a good deal could be done by paying attention to the temperatures in canned goods stores, and seeing that these are as cool as possible. Grocers and warehousemen should also be encouraged to do the same. Cool storage not only reduces the number of hydrogen swells, but it has a beneficial effect in preserving the natural colour of the goods. This was seen in some experiments at Cambridge on strawberries canned in lacquered cans without artificial colour. Those stored at 34° F. kept their natural colour exceedingly well for a long time. They even improved a little on their original condition, because a certain amount of the natural colour which came out of the fruit during cooking was gradually reabsorbed. The contents of cans from the same batch stored at 77° F. were very much bleached after three months, while another lot stored at about 55° to 60° F. were less bleached, but not nearly so good in colour as those in the cold store.

Another suggestion which I have seen put forward recently in the *Canning Age*, in an article by Messrs. Clough, Shostrom, and Clark—some of you may have read it—is that a small quantity of sulphur should be added to products of low acidity to prevent hydrogen swells. Judging from studies we have made on tinplate at Cambridge, I should say that it is probably quite true that sulphur would give protection at low acidity, although I do not agree with the explanation of the matter given in the article. I think, however, in view of the fact that sulphur is known to do harm in many cases, that it would be very dangerous for the ordinary canner to play about with this remedy; for one thing, it might even lead to legal complications. It is certain, at any rate, that sulphur must not be added together with acid in the hope that two medicines will be better than one, because at high acidity it would certainly have a disastrous effect.

I wish now to turn to quite a different subject—viz., the use of a cold store to the canner. At the Low Temperature Research Station we are peculiarly well situated to obtain information on this subject. We have there, as some of you saw last year, a large number of chambers held at different temperatures, and we can study the effect of holding the fruits or vegetables at temperatures just above freezing point or actually in the frozen condition.

What I have seen of fruit and vegetable storage convinces me that every large cannery should possess a refrigerating plant in order to prevent waste, to form a reservoir, or buffer, which will ensure steady working during the fruit season and eliminate very largely the week-end problems. Such a plant would also prolong the canning season and so permit of greater output.

The length of time during which fruit may be stored in a condition fit for canning, without actually being frozen, depends to a large extent on its condition when it goes into the store, but it is quite safe to say that at 34° F. it will keep twice as long as it otherwise would, and in many cases three or four times as long. Thus strawberries in chip baskets will keep a week or possibly eight or nine days; we have actually stored strawberries twelve and even nineteen days. These were placed in store within an hour or two from the time of picking and were rather under than over ripe. Red cherries were kept nineteen days with about 3 per cent. of waste; plums may be kept one month or even six weeks, I am told, if they are pulled just in the right condition, and peas in shells or shelled may be kept three weeks to one month without obvious deterioration.

In the United States of America a large trade is being developed in frozen products of all kinds, especially fruits in syrup, which are delivered to the consumer in the frozen condition; such products may also be canned, and do not differ appreciably in appearance from the same products canned fresh, although it must be admitted that in some cases they have a slight stored flavour. This is more noticeable with some products than others.

A number of experiments on cold storage from the canner's point of view—*i.e.*, from the point of view of the preservation of good appearance and flavour—have been, and are still being, carried out at Cambridge, and it is hoped that a good deal of definite and useful information on various points may be gained before next fruit season.

Replies to Enquiries (*Continued from p.* 333).

141. *How to prevent discoloration in sausage?*

The information given in your letter is not sufficient to enable us to state with certainty the cause of the discoloration of your sausages, but it is generally due to one of the causes given below.

Practically all the largest manufacturers use artificial colour for both pork and beef sausages; this is generally sufficient to maintain the fresh appearance of the meat throughout the summer. They also use preservatives which help in maintaining the natural colour.

Kindly give us information on the following points if you wish us to go further into the matter:

1. Type of meat used (pork or beef).
2. Is artificial colour employed?
3. Do you use coloured or plain rusks?
4. Type of preservative, if any.

A Display of Salmon at one of the Coastal Depots.

The Handling and Transport of Fish

By JOHN T. CLARK
Billingsgate Market.

Much of the equipment and practice in the fish trade is out of date. The author indicates the weak points, and discusses the whole question of raising the efficiency and improving the hygienic conditions under which the handling and transport of fish are conducted. The author is of the opinion that an all-round improvement is impending and that it is, in fact, being enforced by the phenomenal increase in the consumption of frozen fish.

THERE IS much room for improvement in the existing methods of handling fish at practically every stage of the journey from trawler to table. The first step is to realise that fish is an important and valuable foodstuff. The present-day market attitude is still happy-go-lucky, the feeling being that anything will do so long as the catch is disposed of.

Trawlers.

These represent the principal form of catching power and operate over a very wide area in their efforts to supply the British Isles. The method of catching employed is to drag a huge open-mouthed net (the trawl) over the sea floor for a number of hours. The trawl is hauled on board the vessel by a steam winch and the contents dropped on to the deck by opening the closed end of the net.

The fish are then "gutted," sorted, and packed, with ice in the holds, in "pounds" built of wooden boards. It must be here strongly emphasised that putrefaction is a bacterial process, and, consequently, everything must be done to prevent infection and to retard the breeding of the bacteria. Gutting is sound practice, as the partially digested food in the entrails is an excellent breeding-ground. Packing in ice lowers the temperature and therefore tends to reduce the development of the bacteria. Wood is an unsuitable material to use for the "pounds," as the boards soak up the slime of the fish, and soon provide sources of infection. Some attempt is made to wash the boards and the internal fittings of the holds at the end of each trip; but cold water is not sufficiently effective, and powerful disinfectants are precluded on account of the ease with which fish will pick up foreign flavours. The ideal internal fittings of the holds, etc., would be an impermeable material, preferably stainless steel. The stowing of large quantities of fish in the holds with layers of ice is detrimental, as the lower sections become crushed and pitted by the ice and are exposed to the water and slime percolating through from the upper layers.

Handling fish at sea in bad weather is a difficult and dangerous business, and carelessness is to a certain extent excusable, but as regards equipment nothing should be spared which will help to land the fish in better condition than is usually the case.

A trawler's trip varies from two or three days to a month or more. On short trips with small catches, existing methods are fairly satisfactory. The solution of the difficulties in fishing far from home would appear to be brine freezing at the fishing-ground.

Whether the trip is a good one or a poor one, there comes a day when the time that the fish will keep compels the trawler's immediate return to port.

Coastal Ports.

Tides usually govern the hour at which trawlers dock. Night is preferred to day, as the fish can be landed before the market starts. The methods in use have changed very little in the past decade.

The usual method of landing is for the pounds to be broken down, and the fish and ice shovelled into a basket. The basket is swung into the quay, which may or may not be the market, and the contents sorted for species and size. After sorting, the fish is weighed and put into "trunks" or "kits" without ice, and displayed for sale. The fish may stand for several hours before it is sold, and even after being sold a considerable time may elapse before buyers attend to their purchases. Some markets are uncovered, but the more ambitious and important possess corrugated iron roofs. The effect on the fish after several hours' standing on a hot summer's day without any attempt at preservation may be imagined.

In some cases the fish is simply laid out on the market floor at the mercy of every hobbledehoy in hobnailed boots. Many reasons can be advanced why this uncleanly custom should be prohibited.

After sale the buyer removes his purchases to his own premises, where the fish is again weighed, sorted and packed for transport by rail inland.

Packing for this purpose frequently leaves much to be desired. Returnable wooden boxes are used without the dirt from previous journeys being removed. In very bad cases, too little ice and too much fish are put in the boxes, and the lid is forced into position by the simple process of standing on it while it is nailed into position. The more obvious faults of these practices are easily seen, after it has been realised that to keep fish it must be handled as little and as carefully as possible to avoid breaking the tissues. Further, fish should not be exposed to the air longer than is absolutely necessary.

Billingsgate Market at 5 a.m.

Rail Transport.

Billingsgate Market being the most important distribution centre, it can be assumed that the fish is being consigned to London.

It is only during recent years that covered trucks for rail transport have become general, and the writer remembers many bitter arguments over covered trucks. Properly packed fish can be transported in winter, in ordinary waggons covered with tarpaulins, without much deterioration. For transport in hot or close weather, covered trucks are essential, and insulated waggons would be better still. These troubles are disappearing, as covered waggons are available now in sufficient numbers at most ports.

There is one method of rail transport, now happily almost extinct, which shows how not to handle fish. That is the railing of large quantities, in glut periods, loose in the waggons, adding a few hundredweights of crushed ice, covering the whole with a tarpaulin and hoping for the best. Arrived at London the fish is shovelled on to a van for transport to the market. The gradual dying out of this method is its most commendable feature.

The use of horse-drawn vehicles at Billingsgate Market, at first glance, appears to be old fashioned. The horse vehicle is still the best form of transport from terminus to Billingsgate, because a pair-horse van carrying four or five tons can be manœuvred in far less space than a motor lorry. The accompanying photograph shows the congestion which exists at Billingsgate while the majority of folk are still in bed.

An extraordinary variation exists in the efficiency of the rail service from various ports. The shining example is the service from Aberdeen. Fish forwarded from the port soon after mid-day to-day is ready for delivery at Billingsgate at 5.0 a.m. to-morrow. No doubt the fact that either the L.N.E.R. or L.M.S. can be used for this traffic accounts for this unusual efficiency. On the other hand fish sent on Saturday from ports very much less distant than Aberdeen has been known to arrive very late on Monday morning.

In countries like the U.S.A., where rail journeys are reckoned in days and not in hours, the transport of fish is a very difficult matter. The original method was to pack the fish, either fresh or frozen, into insulated waggons, fitted with hoppers containing a mixture of ice and salt. With carefully insulated vans this method was fairly reliable for the shorter distances. With the advent of brine frozen fish, the American public quickly realised that a first-class frozen article left very little to be desired as an article of diet. The demand for frozen fish in cities six days distant from the coast led to experiments being made in order to discover some means of transporting hard frozen fish over these enormous distances. Two solutions were forthcoming—viz., dry ice and the silica gel process.

Group of Billingsgate Porters.

Dry ice is the trade name given to solid carbon dioxide. The hard frozen fish is packed into insulated cars, and blocks of dry ice placed in different positions in the car, and finally a few pounds of crushed dry ice sprinkled over the whole consignment. The car is then sealed and forwarded to some far away town.

The advantages of dry ice are, firstly, it produces a much lower temperature than ordinary ice. Secondly, the solid dry ice becomes a gas without any intermediate liquid stage; consequently the cargo arrives in clean hard condition, and can be removed immediately to the cold store proper.

The silica gel process is a simple form of transportable refrigerator which is automatic in action. The great advantage is that, unlike most refrigerators in use on railways, power is not supplied by the axles and the machine continues to function whether the car is moving or is at rest in a siding.

How Fish should not be Transported.

Billingsgate Market.

To return to London, tradition states that the origin of this market was a quay built by King Bellin around 400 B.C.

To-day, however, the market is covered and consists of 39,000 sq. ft. of floor space, which is divided into 261 stands of 8 sq. ft. each, the remaining space being occupied by avenues between the stands.

Billingsgate can clear 1,000 tons of fish a day, and a vivid imagination is unnecessary to conceive the terrible congestion which ex-

ists in and around the market.

The packages of fish are transported inside the market on the heads of the porters, the crowded conditions rendering the use of barrows difficult.

One great advantage of Billingsgate Market's position is that fish can be brought direct from the fishing grounds by water, and supplies amounting to approximately 12 per cent. are brought by carrier vessels from fleets fishing in the North Sea.

Interior of Billingsgate Market.

There are one or two disadvantages attaching to this system. There is difficulty in transhipping the fish from the catching vessel to the carrier; in bad weather also, owing to the time taken by the carrier to return, there is a limit to the area over which the fleet can fish. At present considerable difficulty is experienced in getting the fish to London in hot weather in first-class condition, and no doubt these three factors account for the drop in water-borne fish as compared with pre-war days.

Necessary Improvements.

From the foregoing it is unnecessary to emphasise that insufficient care is taken of a very valuable foodstuff that the fishermen have frequently risked their lives to obtain.

Considerable experimental work has been carried out on two specially chartered and fitted trawlers (S.T. *Ben Meidie* of Aberdeen and S.T. *Peter Carey* of Milford Haven) with the object of landing the fish in better condition than is at present possible. A very detailed and exhaustive report of these experiments is available from the Department of Scientific and Industrial Research, Food Investigation Special Report No. 37.

The upshot of this report is that every utensil or fitting used for fish should, wherever possible, be made of stainless steel—steel gutting troughs, steel pounds for storing the fish, etc. The two trawlers above mentioned were fitted with a steam sterilising plant, so that everything used for handling and storing the fish could be sterilised. The outcome of these experiments was that in a number of cases experts who examined the fish on landing were deceived as to the length of time which had elapsed since they were caught. Fish which had the appearance of having been caught two or three days only, proved to have been dead nearly a week.

It is certain that scientific investigations conducted under actual practical conditions—such as those cited above—will lead to important modifications in the present-day practices of handling and transporting fish.

Calculation of Formulæ of Ice-Cream Mixes

(*continued from page* 323)

Milk	68·95 lbs.
Cream (50 per cent.)	8·39 ,,
Condensed, whole sweetened milk ...	13·92 ,,
Sucrose	8·23 ,,
Gelatin	0·50 ,,
Mix weight	99·99 ,,

This formula gives on theoretical check an analysis as follows:

Fat	8 per cent.
M.S.N.F.	10·0 ,,
Sucrose	13·5 ,,
Gelatin	00·5 ,,
Total solids	32·0 ,,

which is the desired result. Again, as with the first example, a mix formula for any desired mix weight, or to use up any desired weight of one product can, by simple proportion, be computed from the 100 lbs. mix formula calculated.

It will therefore be seen from the foregoing that by adopting this simple application of algebraic manipulation to the problem of mix calculation, the ice-cream manufacturer is at once in the position of being able to vary infinitely his mix analysis as circumstances may dictate, and further is in the useful position of being able to compound a mix of any weight to a given percentage composition, utilising any surplus ingredients he may have on hand.

Enquiries and Replies

Enquiries

139. We wish to buy pigs' liver (imported). Can you give us a likely address?

140. Required a formula for coffee essence.

141. I do not require a sausage formula, but in warm weather my sausage discolours. I do not mean to say it sours, but just loses its fresh, pink colour. When the weather is cooler it keeps perfectly. My water is absolutely cold, and the best of rusks and the freshest of meat are used, yet my colour is changeable. Can you suggest the source of trouble?

142. Names of makers of saccharometers (of Issachar pattern) required, and instructions as to use.

143. At the moment I am particularly interested in filling, corking, and capping machines, both for bottles and tins, and all accompanying machinery used in the general routine of mixing, packing, etc., including milling machines, glass containers of three gallons and upwards, with filling taps, glass-lined tanks, tanks of special metal or composition for holding ·880 ammonia and all agitating devices.

144. Name and address of the manufacturers of a sweet pickle sold under the registered name of "Garle-Vous" required.

145. Information wanted on the process of putting pigs' head brawn into sealed glass jars, together with the utensils required.

146. Information required on Donachie's peel curing process.

147. I have a customer anxious to obtain a machine for cutting biscuits, to be driven by electricity, and should be much obliged to be put in touch with the manufacturers of this class of machinery.

Replies to Enquiries

125. *Advice required on latest processes for canning sour-krout.*

Two methods of canning are now being followed by some of the principal packers, and we think the majority favour what we will designate as process No. 1, because it offers a factor of safety or, may we say, insurance against under-sterilisation, whereas process No. 2 does not include a foolproof or positive assurance that every can will be properly handled to avoid loss.

Process No. 1.—This consists of heating the krout after it is taken from the curing vats to a temperature of about 120° in a tank equipped with a steam coil, the object being to have it just as hot as the operators on the filling-table can handle it in filling the cans. The krout is then placed on our hand pack filler, where it is placed in the cans according to the weights set for each container, and a 2 per cent. brine solution added before the cans are exhausted. The cans next pass through an exhaust box of the steam type and are given from three to five minutes' exhaust. The cans are next sealed and then automatically delivered from the closing machine to the continuous cooker and cooler, where they are subjected to a ten to twelve minutes' cook, and a five to six minutes' cool, which figures are based on a No. 2½ or No. 3 size American can.

Process No. 2.—The krout is filled in the same manner, with all preceding operations up to that point the same. The brine is added, and the cans are subjected to an exhaust in live steam, which will produce at least 180° in the centre of the can, and this exhaust will have to be of from fifteen to twenty minutes for the same size can as figured above. The cans are next sealed and run through hot water for a period of two or three minutes, which the canners state is to wash the cans, but in reality it also assists in the cooking. The cans are then cooled, as without cooling the krout would continue to cook and become mushy.

The claim for the second process consists in a more brittle and whiter krout being obtained, but some of the largest canners, like the Empire State Pickling Co., of Phelps, New York, tried the second process after having used the first for a good many years, and in building a new plant recently they installed process No. 1.

Krout is packed principally in Nos. 2, 3, and 10 cans, but some special sizes are also used. The following table will give you the length of exhaust and cook for these various sizes of cans, and it will be well to prepare for the maximum length if the canner is disposed to spend the amount of money involved for the maximum capacity machines.

	No. 2 Cans.	*No. 3 Cans.*	*No. 10 Cans.*
Exhaust	2 to 3 min.	3 to 5 min.	7 to 8 min.
Cook	8 to 10 ,,	10 to 12 ,,	15 to 18 ,,
Cool	4 to 5 ,,	5 to 6 ,,	7 to 9 ,,

C. S. DU MONT, LTD.

134. *Information on preparation, etc., of gravy powders and gravy salt required.*

Gravy salt or powder in this country is composed of two or three essential ingredients, and the different manufacturers vary the proportions to suit their own customers. The following are the essential points.

Colouring matter.—This is generally burnt sugar derived from solid glucose. Cane sugar caramel is not liked, as the flavour too closely resembles liquorice. Aniline colours are sometimes used, but they are objected to because of their staining power on the tongue.

Thickening.—Many gravy compounds have a thickening agent added which is invariably composed of cornflour or other cereal starch.

Salt.—This is the ordinary coarse table salt, and is the chief ingredient.

Some gravy salts are placed on the market without the thickening ingredient. Coloured starch is also available without a salt addition, and endless other variations are offered. We give you below an analysis of one of the products we have recently examined, and we shall be pleased to give you further information if you will give us exact information as to your requirements.

Gravy Salt.

1 part caramel.
5 parts coarse ground table salt.

Warm the caramel to reduce the viscosity and mix it into the salt with any type of mixing machinery. The mixture should be solid, but capable of being compressed into tablets if required.

136. *Names of firms supplying devices for easily opening tin cans required.*

A correspondent writes: "For quick tin and can opening machines, the best firm is Sprague Canning Machinery Co., Chicago. I have used them extensively for opening thousands of small cans; they are very reasonable in price, and fit easily to the table."

140. *Required a formula for Coffee Essence.*

2 lbs. ground coffee (blended)
½ gall. boiling water.

Mix in a pan, cover, and stand in the warm for a few hours, then strain.

Press the dregs and get all the fluid out.

Re-infuse the dregs in ½ gall. boiling water for 1 hour, then press and strain, and add to the other liquid.

Evaporate the whole liquid to 60 fluid ozs. in all (3 imperial pints), then add:

2 lbs. loaf or granulated sugar.
5 fl. ozs. caramel colour.

Stir, then bottle.

Benzoate of soda was the usual preservative in coffee essence, but sterilisation of the filled bottles is better. Sterilise at 212° F. for 30 minutes for 8-oz. bottles, and at the same temperature for 45 minutes for larger (16-oz.) bottles. If the water is hard, then add 1 oz. sodium bicarb. to 20 galls. beforehand.

(*Continued on page* 328.)

Trade News

Blairs Limited.

The firm of Blair, Campbell, and McLean, Ltd. (established in 1838), has changed its name to Blairs, Ltd.—incorporating Blair, Campbell, and McLean, Ltd., Harvey Engineering Co., formerly McOnie, Harvey and Co., Ltd., and A. and P. W. McOnie. The last-named engineering firm was acquired in the year 1917. From the Harvey Engineering Co., Ltd. (of Glasgow), have been taken over the entire business, including goodwill, drawings, patterns, and certain of the technical staff, so that all replacements, repairs, and additions to all equipment previously supplied by the Harvey Engineering Co., Ltd., can be dealt with perfectly satisfactorily.

In recent years the works of Blairs, Ltd., have been extensively enlarged, and now comprise pattern and woodworking shops, pattern stores, iron, steel, and brass foundries, heavy and light machine shops equipped with the latest electrically operated machine tools, cranes, etc., and several large erecting and fitting shops. In addition, there are extensive shops for constructing copper, aluminium, and stainless steel work of all kinds, also welding shop, smithy, and a well-equipped laboratory, where metallurgical tests and various research work is carried out, and the whole works are laid out and provided with all facilities to enable all plant to be constructed and despatched in the minimum time.

The firm particularly specialises in the manufacture of sugar-making and refining, distilling, brewing, malt extract, chemical, evaporating, artificial silk, tannin extract, wood distillation, low temperature carbonisation, solvent recovery, gelatine and glue plant, and equipment for producing all kinds of food and other trade products, including the recovery of various by-products.

* * *

Vacuum Cleaners.

The "Visco" Engineering Co., Ltd., London, have issued an interesting and well-illustrated booklet describing their Industrial Vacuum Cleaners.

* * *

Bottle Cleaning.

The Thomas Hill Engineering Co. (Hull), Ltd., are to be congratulated on their catalogue, No. 32, which deals with a comprehensive variety of bottle-cleaning machines and systems. This is a large production, generously illustrated, and gives full particulars of the machines and equipment offered.

Jelly Making.

We have received a note from Pomosin Products, Ltd., London, to the effect that with "Pomosin" a jelly is made and set in three minutes by cold process. "Pomosin" is claimed to be a natural fruit product, and jelly made from it is said to keep fresh for weeks and not to go mouldy. It has been on the market in Germany, Austria, and Holland for about two years.

* * *

Bakers' References.

From the Antelope Co., London, we have received a small book giving recipes for scones, cakes, buns, shortbreads, etc., using "Antelope" as an aerating material. This book contains much useful information and the illustrations form a very attractive feature.

* * *

Refrigerating Plant.

Messrs. Pearson, Garforth, Ltd., Bradford, have purchased the whole of the patterns, drawings, and the finished and partly finished machines of Messrs. Thomas Lister and Co., Ltd., Perseverance Brass and Iron Works, Brighouse, and are in a position to give prompt delivery of spares for any size of their units.

* * *

Bread Slicing and Wrapping.

One of the chief centres of interest and attraction at the Atlantic City Convention was the display of machinery exhibited by the Battle Creek Wrapping Machine Co. (represented here by C. S. du Mont, Ltd., London). The Simplex Slicing and Duplex Bread Wrapping Machines—illustrated here—commanded great admiration, and they contributed in no small measure to the success of the Convention.

Cold Storage Insulation.

It is extremely gratifying to learn that an important order from America has recently reached a British firm—Messrs. Newalls Insulation Co., Ltd., who are well known as manufacturers and installers of heat and cold storage insulations. This order is for the supply of sufficient of their 85 per cent. magnesia heat insulation to cover 150 miles of steam piping. A further order from Canada calls for 22 miles of pipe insulation. These two orders will absorb 10,000 tons of raw material.

* * *

Heather Brew.

We have had the privilege of sampling an aerated beverage—"Heather Brew"—made entirely in Scotland. This is a really good drink, and should quickly establish itself in popular favour. Messrs. Cumming Bros., of Glasgow, supply the essence.

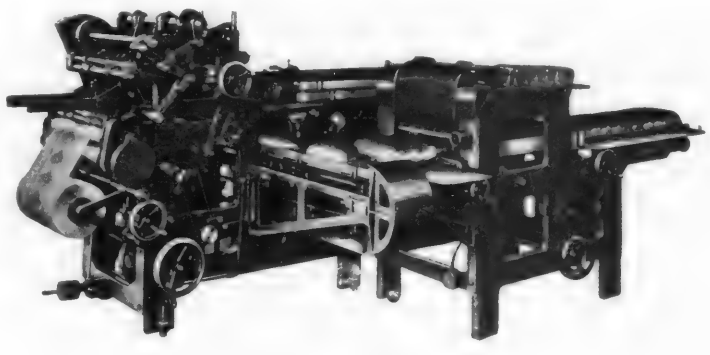
* * *

The B.I.F.

Nearly seventy firms have together applied for 12,000 square feet in the foodstuffs and tobacco section of the British Industries Fair to be held at Olympia, London, from February 16 to 27.

New exhibitors include the leading metal box printers and canners, who intend to show how the attractive container can help to sell the goods. There will again be a good display of refrigerators and soda-fountain equipment, and the section will also include biscuits, cake, confectionery, beverages, and prepared and canned food of all kinds.

Coin-operated vending machines, which were previously in the schedule of trades in the Birmingham section of the Fair, will be shown in London for the first time.



Financial News

The Editor cannot accept responsibility for any errors which may appear in the Financial News Section.

BANK RATE (1929–1930)

1929.		1930.	
Feb. 7	5½ per cent.	Feb. 6	4½ per cent.
Sept. 26	6½ ,, ,,	Mar. 6	4 ,, ,,
Oct. 31	6 ,, ,,	,, 20	3½ ,, ,,
Nov. 21	5½ ,, ,,	May 1	3 ,, ,,
Dec. 12	5 ,, ,,		

In spite of the general trade depression experienced by equipment concerns during the past financial period, some companies were able to expand their area and volume of trade, although, owing to the keen competition for certain products and materials, the prices obtained still further declined.

In the case of the **British Aluminium Co., Ltd.**, the balance of net profit realised during the year was £279,793, which compares with a net profit of £284,063 for 1928, and £279,388 for the previous twelve months. This figure was arrived at after debiting £23,085 for directors' fees, £103,224 for debenture service, and £37,000 as provision for taxation, these three items totalling £163,309 as against £157,319 in 1928. The following is a summary of the final profit and loss appropriation account :

	£	£
Brought forward from 1928	33,843	
Net Profit, year ended December 31, 1929	279,793	
Disposable Balance		£313,636
6% dividend on £299,570 £1 Preference Shares ...		17,974
10% dividend on £1,001,034 £1 Ordinary Shares ...		100,103
Allocated to Depreciation Reserve		50,000
To Staff Benefit Fund		10,000
Transferred to General Reserve		100,000
Carried forward to 1930		35,559
		£313,636

The principal balance-sheet items are enumerated below :

	£
Property	2,871,423
Interests in Subsidiary Companies	1,077,656
Interests in Allied Companies	426,281
Stocks on Hand	319,708
Investments	405,873
Sundry Debtors	267,669
Cash	149,656
Sundry Creditors, including Reserve for Taxation	350,892
Due to Subsidiaries	89,915
Reserve Fund	1,050,000
Depreciation Reserve	1,000,000
Debenture Redemption Funds	482,911
5% prior lien Debentures outstanding	745,600
5½% Debenture Stock	507,215

At 97, the prior lien debentures return £5 3s. per cent, while at 101 the yield on the debenture stock is 5·43%. In 1929 the debentures reached 99, the lowest price being 94, and the stock reached 102½, with 97 as the lowest marking. An interim dividend of 4%, less tax, was payable on the ordinary shares on October 1 last, and these shares, which reached 52s. in 1929, were recently quoted at 38s. 9d., upon which basis the return is 5·16%. The preference shares fluctuated between 20s. 7d. and 23s. 3d. in 1929, and changed hands recently at 22s., at which price they yield 5·45%.

On October 2 an interim dividend of 3%, less tax, was payable to the holders of the ordinary share capital of **Carrick's (Caterers), Ltd.**, this rate being the same as that paid a year ago. The company's financial year closes on January 31, and the profit and loss account covering the 1929-1930 period disclosed a profit of £49,233, as compared with a profit of £35,379 for the previous twelve months. From the 1928-1929 appropriation the sum of £8,478 was brought forward, after debiting £1,263 under the heading of preliminary expenses, and this enabled a final dividend of 5% to be paid on the ordinary shares, making 8% for the year, while the following appropriations were also made :

	£
Preliminary expenses written off	15,780
Taxation Provision	7,514

This left £8,657 standing to the credit side of profit and loss account. The capital consists of £280,000 7½% cumulative preference £1 shares, and £140,000 ordinary 10s. shares, and the company owns the entire share capital of **Tilley and Co., Ltd.**, and also the entire ordinary share capital of **W. and J. McLintock, Ltd.** At the recent price of 21s. 7d. the preference shares yield 7%.

Although the demand for molasses as a cattle food, and as material for the production of industrial alcohol, as well as in the production of yeast, was well maintained during the greater part of 1929, in June, July, and August of the present year the demand dropped materially, and this fact, in conjunction with a weakening of the freight market, is mainly responsible for the passing of the interim dividend on the ordinary shares of **United Molasses Co., Ltd.** The company is in an exceedingly strong financial position, and the income during 1929 aggregated £1,296,297, as compared with £263,448 for the previous twelve months. Depreciation of motor vessels and steamships accounted for £106,879, and after debiting the general expenses the balance of profit was £1,146,458, the appropriation account being made up as under :

	£	£
Brought forward from 1928 (excluding balances remaining in Subsidiary and Associated Companies)	8,888	
Profit, year ended December 31, 1929 ...	1,146,458	
		£1,155,346
Income Tax		97,342
Preference Dividend		66,969
Ordinary Dividend, 25%		596,817
Transferred to Reserve		350,000
Allocated to Staff Fund		10,000
Carried forward to 1930		34,218
		£1,155,346

The following were some of the chief balance-sheet items :

	Dec. 31, 1929. £
Motor Vessels and Steamships	2,066,208
Instalments on account of Vessels under Construction	436,729
Investments in Subsidiaries	3,361,680
Cash and Debtors	528,902
Creditors	293,191

The consolidated balance-sheet showed the following assets :

	£
Stocks of Molasses, etc.	1,860,231
Advance Payments on Purchases of Molasses ...	453,949
Debtors	1,272,150
Cash and Bills Receivable	930,215

The preference shares were recently quoted at 18s., and the ordinary at 21s., each class being of £1 denomination.

As against 10% a year ago, an interim dividend of 6%, less tax, has been announced on the ordinary share capital of the **Direct Supply Aerated Water Co., Ltd.** The company was registered on March 9, 1904, the authorised capital being £247,500, all of which has been issued and paid up in the form of £7,500 7½% first cumulative preference £1 shares, £40,000 10% second cumulative preference £1 shares, £50,000 8% cumulative participating preference £1 shares, and £150,000 ordinary 5s. shares. The payment of a final dividend of 16% made 26% for the year, while the sum of £6,657 was left over and will be brought into the next appropriation, as compared with £5,447 last year. The second and the participating preference shares carry voting rights under certain circumstances.

On October 11 the warrants were posted in connection with the payment of an interim dividend of 3½% on the ordinary shares of **Radiation, Ltd.,** the gas stove manufacturers, this rate of dividend being the same as last year's interim. The company was registered on June 2, 1919, and owns the entire capital of the **John Wright and Eagle Range, Ltd.,** the **Richmond Gas Stove Co., Ltd.,** the **Davis Gas Stove Co., Ltd., Fletcher, Russell and Co., Ltd.,** and of **Wilsons and Mathiesons, Ltd.** In 1920, and again in 1927, the capital was increased, and the authorised sum is now £5,000,000, comprising £1,600,000 6% cumulative preference £1 shares, £2,400,000 ordinary £1 shares, and £1,000,000 of shares not yet classified. Of this capital a total of £3,350,084 has been issued and paid up in the form of £1,087,525 preference and £2,262,559 ordinary shares, and the accounts covering the last financial year, which ended at December 31, showed an income of £295,997, which compares very favourably with an income of £279,651 for the previous twelve months, being an increase of £16,346. Consequently, not only was the ordinary dividend of 12½% maintained, but a substantially larger sum was carried forward to the next appropriation, the final figures being balanced as follows:

	£	£
Brought forward from 1928	123,925	
Income, year ended December 31, 1929 ...	295,997	
Disposable Balance	£419,922	
6% dividend on £1,087,525 Cumulative Preference £1 Shares	65,251	
Less tax at 4s. in the £	13,050	
		52,201
12½% dividend on £2,262,559 Ordinary £1 Shares	282,820	
Less tax at 4s. in the £	56,568	
		226,252
Carried forward to 1930		141,469
		£419,922

The combine is in a very strong financial position, and in addition to a cash balance of £400,089, the combined balance-sheet showed the value of investments to be £1,366,904, including shares in gas undertakings, while goodwill is stated at £152,039. In 1929 the preference shares reached 23s., and were recently quoted at 21s. 9d., and the ordinary shares reached 49s. 6d. in 1929, and changed hands recently at 36s., at which price they yield 6·94%.

The net profit realised by **Willer and Riley (1910), Ltd.,** pea packers and produce merchants, during the year to June 30 last, amounted to £5,956 as compared with £5,930 during the previous twelve months. After adding £5,079 brought forward, and deducting £2,000 transferred to reserve, the available balance is £9,035, enabling the dividend of 10% to be paid on the £50,000 shares, less tax, as before, and a balance of £5,160 carried forward to 1930-1931.

As the result of an increased acreage, and the securing of additional contracts, the accounts of certain sugar beet companies show a substantial improvement. For example, the balance of net profit realised by the **Lincolnshire Sugar Co., Ltd.,** during the year to March 31 last was £65,046, which compares with a net profit of £22,864 for the previous twelve months, and although no dividend is being paid on either the preference or the ordinary capital, the balance to the debit of preliminary expenses has been written off, and a substantial sum carried forward to the next account. The company's appropriation account is made up as follows:

	£	£
Brought forward from 1928-1929	12,770	
Net Profit, year ended March 31, 1930 ...	65,046	
	£77,816	
Transferred to Depreciation Reserve		16,200
Preliminary Expenses written off		30,512
Carried forward to 1930-1931		31,104
		£77,816

The issued capital consists of £325,000 7% cumulative participating preference shares of £1, and £7,500 ordinary shares of 1s. After payment of a dividend on the preference shares, the directors are entitled, as extra remuneration, to 5% of the profits distributed each year. There is also an issue of 5% first mortgage debenture stock which is guaranteed as to principal and interest by H.M. Government under the provisions of the Trade Facilities Acts. The nominal daily capacity of the company's beet sugar factory at Bardney is 1,000 tons of beets.

The accounts of **Lovell and Christmas, Ltd.,** reflect the downward movement of commodity prices during the past twelve months, the balance of net profit for the financial period ending at the middle of June being only £51,397 as compared with £103,677. Consequently the dividend on the company's ordinary share capital has been reduced from 10 per cent. to 2 per cent., as shown below:

	£	£
Brought forward from 1928-1929 ...	101,228	
Net Profit, Year to mid-June, 1930 ...	51,397	
	£152,625	
6 per cent. dividend on £750,000 Cumulative Preference Shares of £1 each		45,000
2 per cent. dividend on £750,000 Ordinary Shares of £1 each		15,000
Carried forward to 1930-1931		92,625
		£152,625

Owing to the liquidation of certain subsidiary companies, the sum of £110,497 was applied out of the specific reserve to meet the losses on loans and investments, while from the same reserve a further £22,956, making £133,453 in all, was taken for the following purposes:

	£
Written off book value of Premises	11,068
Bad Debts written off	3,337
Reserve for Debtors and Trade Loans	8,551
	£22,956

These transfers had the effect of reducing the credit balance of the specific reserve account to £57,127, so that to strengthen this fund the sum of £94,535 was transferred from the general reserve, giving £151,662 as specific and £100,000 as general reserve. This total of £251,662 compares with £385,115 a year ago, and, although the funds are not separately invested, they offset the amount standing as an asset under the heading of goodwill and trade marks—viz., £234,727 at cost. Some of the principal balance sheet items are as under:

	£
Premises	410,196
Subsidiary Companies, including Loans and Current Accounts	1,478,932
Owing to Subsidiaries	150,413
Debtors	838,882
Creditors	249,625
Bank Loans	715,638
Cash	101,644
Stocks	40,970

The ordinary shares changed hands recently at 13s. 6d., and the preference at 13s. 4d.

The final accounts of the **Central Sugar Co., Ltd.**, which was registered five years ago, and which owns a beet sugar factory at Woodston, Huntingdon, show a net profit of £56,075 after debiting £65,000 for depreciation. To this profit must be added the sum of £69,587 brought forward from the previous accounts, making a total of £125,662, and this amount has been dealt with as under :

	£
Income Tax Provision	25,000
Investment Depreciation	28,125
Transferred to General Reserve	40,000
15% dividend on £175,000 Ordinary £1 Shares	26,250
Carried forward	6,287
	£125,662

The company's dividend record is as follows :

November 14, 1925, to March 31, 1927 ...	10% actual.
1927-1928	10% p.a.
1928-1929	10% ,,
1929-1930	15% ,,

STOCK AND SHARE LIST

	Oct., 1930.	*Par Value.*	*Sept.*, 1930.
Aerated Bread : Ord. ...	17/5	£1	18/6
6½% Pref.	18/9	£1	18/9
Apollinaris : Ord.	7/-	£1	7/10
Assoc. Biscuit : 6½% Pref. ...	22/3	£1	23/-
Avery (W. and T.) : Ord. ...	53/-	£1	53/6
Benger's Food : Ord. ...	30/6	£1	30/6
6% Pref.	4¾	£5	4¾
Bovril : Ord.	24/2	£1	24/9
Deferred	39/4	£1	39/3
6% Pref.	21/9	£1	22/-
4½% Deb	84½	£100	84
British Aluminium : Ord. ...	38/9	£1	40/-
6% Pref.	22/-	£1	21/-
British Thomson Houston :			
7% Pref.	22/6	£1	21/11
Cadbury : 8% 2nd Pref. ...	27/3	£1	27/9
Caley (A. J.) : 5% 1st Pref. ...	6/6	£1	6/6
7½% "B" Pref. ...	9/-	£1	9/-
8% "B" Pref.	9/-	£1	9/-
4% "A" Deb.	57	£100	57
5% "B" Deb.	58	£100	58
Carrs : 6½% Pref.	21/8	£1	21/10
Cerebos : Ord.	6⅛	£1	5⅞
Chivers : 6% Deb.	100	£100	100
Cinzano : 7½% Pref.	21/3	£1	21/3
Clark's Bread : Ord.	21/6	10/-	20/6
Crosse and Blackwell : Ord.	1/11	1/-	2/-
7½% Pref.	11/-	15/-	10/9
English Margarine : Pref. ...	22/9	£1	22/9
Foster Clark : Ord.	48/6	10/-	46/-
Fry's 8% "B" Preferred ...	22/-	£1	22/-
H.P. Sauce : Ord.	92/-	£1	96/6
Holbrooks : Ord.	15/9	5/-	15/-
5% Pref.	4	£5	4
Hill (W.) : Ord.	4/9	£1	4/9
Home and Colonial : Ord. ...	12/9	4/-	14/-
15% Cum. Ord.	46/10	£1	46/3
6% Cum. Pref.	5 11/16	£5	5 1⅞
Hovis : 6% Cum. Pref. ...	23/-	£1	21/10
Imperial Chemical : Ord. ...	20/9	£1	23/-
Deferred	6/-	10/-	7/2
7% Cum. Pref.	23/-	£1	23/3
International Tea : Ord. ...	20/3	5/-	21/6
6% 1st Pref.	20/9	£1	20/6
7% "A" Pref.	23/6	£1	23/-
Jurgens :			
7% Cum. Partg. Pref. ...	23/-	£1	23/-

	Oct., 1930.	*Par Value.*	*Sept.*, 1930.
Liebigs : (Reg.)	14 1⅞	£5	14⅜
(Bearer)	14⅜	£5	14⅜
5% Pref.	96/-	£5	95/-
Lipton : Ord.	5/-	1/-	5/6
5% 1st Pref.	8/6	10/-	8/-
6% Pref.	9/1	10/-	8/10
6% Deb.	98	£100	97
Lyons : Ord.	96/10	£1	95/-
"A" Ord.	95/6	£1	94/-
5% Pref.	20/-	£1	20/3
6% Preferred Ord. ...	21/6	£1	21/6
7% Pref.	26/3	£1	23/6
8% Pref.	28/5	£1	28/9
Maypole Dairy :			
20% Preferred	14/6	5/-	14/-
Deferred	5/-	2/-	5/4
5% Pref.	19/-	£1	19/6
Meadow Dairy : 7½% Pref. ...	23/6	£1	23/4
Mellin's Food : 6% Cum. Pref.	3/9	£1	3/9
Nathan (J.) : Ord.	2/3	1/-	2/3
7% Pref.	16/3	£1	15/9
8% Preferred	8/-	10/-	8/-
Nestlés : 8% Pref.	29/8	£1	29/8
Pascall (J.) : 8% Preferred ...	8/3	£1	8/9
Peak Frean : 5% Pref. ...	18/3	£1	17/2
8% "A" Pref.	25/10	£1	25/3
Radcliffs Edible : Ord. ...	2/2	1/-	2/2
8% Pref.	9/-	10/-	9/-
Radiation : Ord.	36/-	£1	35/9
6% Pref.	21/9	£1	21/-
Salt Union : Ord.	32/-	£1	32/-
7% Pref.	29/6	£1	29/6
4½% Deb.	78½	£100	78
Schweppes : Deferred ...	34/6	£1	35/-
4% Deb.	75	£100	76
Scribbans : Ord.	14/9	£1	13/3
Deferred	2/2	1/-	2/-
Smith's Potato Crisps : Ord.	9/1	5/-	9/6
Spiers and Pond : Ord. ...	16/-	10/-	14/3
6½% Pref.	19/10	£1	19/9
5% Deb.	95	£100	95
Spillers : Ord.	21/4	£1	22/-
6% Pref.	18/3	£1	18/-
Deferred	6/10	£1	7/-
Tate and Lyle : Ord. ...	39/6	£1	41/-
6½% Pref.	23/3	£1	23/-
Unilever : Ord.	46/-	£1	53/-
7% Preferred	23/8	£1	23/6
Union Cold Storage : 6% Pref.	19/8	£1	20/4
7% Pref.	21/11	£1	21/9
10% Pref.	26/6	£1	27/1
United Caterers : Ord. ...	6d.	5/-	6d.
United Dairies : Ord. ...	32/6	£1	31/4
6% Pref.	20/7	£1	20/8
United Glass Bottle : Ord. ...	22/3	£1	21/-
United Molasses : Ord. ...	21/-	£1	37/-

FOOD MANUFACTURE is sent to any address in the World for 10s. per annum. Send your subscription now to LEONARD HILL, LTD., Thanet House, 231-2, Strand, London, W.C. 2.

New Companies

MAURICE LAZARUS AND COMPANY, LIMITED. (250674.) Mincing Lane House, 53-69, Eastcheap, E.C. 3. To carry on the bus. of genl. produce mchts. and agents, etc. Nom. Cap. : £100 in £1 shares.

L. HALSE AND SONS, LIMITED. (250644.) To take over the bus. of a wholesale grocer and provision mcht. cd. on at 29, Redland Street, Newport, Mon., by L. Halse. Nom. Cap. : £15,000 in £1 shares.

CARTER AND SON, LIMITED. (250523.) Bridge Street, Warrington. To take over the bus. of bakers, confectioners, flour dlrs. and millers cd. on at Warrington by Carter and Son, Ltd. Nom. Cap. : £5,000 in £1 shares.

HENRY CRISP, LIMITED. (250599.) 183, Mare Street, Hackney. To take over the bus. of a baker and confectioner cd. on at Hackney by Henry Crisp. Nom. Cap. : £500 in £1 shares.

LORD'S CRISPS, LIMITED. (250635.) To take over the bus. of a mnfr., seller, and dlr. in potato crisps cd. on by A. Lord, at 11, Shuttle Street, Eccles. Nom. Cap. : £500 in £1 shares.

SAULS, LIMITED. (250681.) 1-11, Black Abbey Street, Accrington. To carry on the bus. of retail and wholesale drapers and grocers, warehousemen, mnfrs., mchts., brokers, etc. Nom. Cap. : £3,500 in £1 shares.

ALLEN AND COMPANY (MANSFIELD), LIMITED. (250779.) 9, Church Street, Mansfield. To carry on the bus of provision and genl. mchts., grocers, etc. Nom. Cap. : £4,000 in £1 shares.

WM. CLEMENCE AND SONS, LIMITED. (250706.) To take over the bus. of a wholesale factor of milk products, dairy and creamery engr., etc., cd. on by W. Clemence, at Llanstephan, Carmarthen, as "Wm. Clemence and Sons." Nom. Cap. : £3,300 in 3,000 pref. shares of £1 and 6,000 deferred shares of 1s.

BATESON AND WHALLEY, LIMITED. (250632.) Bridge House Farm, Broughton, nr. Preston. To carry on the bus. of egg mchts., farmers, market gardeners, etc. Nom. Cap. : £300 in £1 shares.

H. J. FINCH, LIMITED. (250807.) 8, Cheapside, E.C. 2. To take over the bus. of a butcher cd. on by H. J. Finch, at 12, Kingsley Road, Hounslow. Nom. Cap. : £1,500 in £1 shares (1,100 pref. and 400 ord.).

BLOCKMALT COMPANY, LIMITED. (250781.) 8, Cook Street, Liverpool. To carry on the bus. of confectioners, tobacconists, mnfrs. of or dlrs. in confectionery, boxes, brushes, toilet requisites, etc. Nom. Cap. : £1,500 in £1 shares.

R. INGRAM AND COMPANY, LIMITED. (250794.) To take over the bus. of a tea, coffee, and cocoa mcht. and grocer cd. on at 259, Ecclesall Road, Sheffield, as "R. Ingram and Co." Nom. Cap. : £100 in £1 shares.

KIJUBIA COFFEE, LIMITED. (250785.) The End House, Marlow, Bucks. To carry on the bus. of planters, growers, and cultivators of coffee, cocoa, and other produce, etc. Nom. Cap. : £100 in 1s. shares.

WAYNE'S STORES, LIMITED. (250849.) To take over the bus. of a grocer, tea dlr., provision and genl. mcht., etc., cd. on by S. G. Wayne, at 19, Uplands Crescent, Swansea, as "Wayne's Stores." Nom. Cap. : £1,000 in £1 shares.

SYDNOPE DAIRY AND FARMS, LIMITED. (250936.) To take over the bus. of a dairyman and farmer cd. on at Sydnope Hall, Darley Dale, Derbyshire, as "Sydnope Dairy and Farms." Nom. Cap. : £30,000 in £1 shares (12,000 pref. and 18,000 ord.).

A. GAIN AND SON, LIMITED. (250916.) Parliament Mansions, Orchard Street, Victoria Street, S.W. 1. To carry on the bus. of butchers, etc., at 29 and 30, Kingly Street, W. Nom. Cap. : £1,000 in £1 shares.

J. W. HART AND SON (SHIPPING), LIMITED. (250865.) 8, The Pavement, Stanford-le-Hope, Essex. To carry on the bus. of dlrs. in and importers and exporters of meat, live cattle, sheep, poultry, provisions, and produce of all kinds, etc. Nom. Cap. : £200 in £1 shares.

STERLING FOODS, LIMITED. (250813.) Central Biscuit Factory, Market Street, Church. To carry on the bus. of mnfrs. of dog, poultry, bird, and cattle foods, etc. Nom. Cap. : £250 in £1 shares.

SOUTHERN INDIA PLANTATIONS AGENCY, LIMITED. (250934.) 3, Throgmorton Avenue, E.C. 2. To act as agents, to carry on bus. as mchts., importers, and exporters, to deal in and make advances upon coconuts, copra, coconut fibre, sisal, rubber, coffee, tea, tobacco, etc. Nom. Cap. : £10,000 in £1 shares.

J. H. CARVER AND COMPANY, LIMITED. (250924.) To take over the bus. of mchts. and importers cd. on by A. H. Carver and Co., Ltd., at Hull and elsewhere, and to carry on the bus. of seed and corn mchts., etc. Nom. Cap. : £15,000 in £1 shares.

SILK CANDY COMPANY (1930), LIMITED. (251005.) No. 1 Factory, Tudor Works, Abbey Road, N.W. 10. To carry on the bus. of mnfrs. of and dlrs. in confectioneries, etc. Nom. Cap. : £3,500 in £1 shares.

STIRK BROS., LIMITED. (251026.) To take over the bus. of wholesale fish and ice mchts., etc., cd. on at Billingsgate, Hull, as "Stirk Bros." Nom. Cap. : £10,000 in £1 shares.

MINCING LANE FINANCE AND DEVELOPMENT COMPANY LIMITED. (251046.) 22, Harp Lane, E.C. 3. To invest capital; to act as agents between mnfrs.; to trade as grocers and tea mchts., etc. Nom. Cap. : £10,000 in £1 shares.

G. AND W. E. DOWNING, LIMITED. (251097.) Spon Lane, Smethwick, Staffs. To carry on the bus. of maltsters, corn, hop, and yeast mchts., etc. Nom. Cap. : £100 in £1 shares.

ZELLER'S, LIMITED. (251087.) 26, Fitzroy Street, W. 1. To take over the businesses cd. on at 26, Fitzroy Street, W. 1, 46a, Mornington Crescent, N.W. 1, and 179, York Road, N. 7, as "J. Zeller," and to carry on the bus. of wholesale and retail bakers and confectioners, etc. Nom. Cap. : £6,000 in £1 shares.

LAKE FISHERIES, LIMITED. (251106.) To take over the bus. of a fish, game, and poultry mcht. cd. on at Bowness-on-Windermere, and at Windermere, Westmorland, as "John Mudd." Nom. Cap. : £100 in £1 shares.

DIRECT GROCERS, LIMITED. (251061.) 101, St. Mary Street, Southampton. To carry on the bus. of grocers and provision mchts., etc. Nom. Cap. : £500 in £1 shares.

T. REDMAN AND COMPANY, LIMITED. (251085.) 2a, Clifton Road, Park Lane, Burnley. To carry on the bus. of grocers and provision mchts., etc. Nom. Cap. : £10,000 in £1 shares.

MAIDSTONE ICE COMPANY, LIMITED. (251071.) 105a, Tonbridge Road, Maidstone. To carry on the bus. of ice and cold storage mchts., etc. Nom. Cap. : £700 in £1 shares.

SPELMONDEN DAIRY COMPANY, LIMITED. (251231.) "Spelmonden," Horsmonden, Kent. To carry on the bus. of dairymen, etc. Nom. Cap. : £100 in £1 shares.

TOWNEND AND BARLOW, LIMITED. (251220.) To take over the bus. of dairymen and retailers of milk cd. on at 4, Nelson Street, Chorlton-on-Medlock, Manchester, as "A. H. Townend and Barlow." Nom. Cap. : £3,000 in £1 shares (1,000 pref. and 1,000 "A" pref. and 1,000 ord.).

SYDNEY JACOBS AND SON, LIMITED. (251281.) 21-22, The Corridor, Billingsgate Market, E.C. To carry on the bus of wholesale or retail fishmongers, etc. Nom. Cap. : £100 in 1s. shares.

Current Literature

Fruit and Vegetable Products

415. Grape Fruit. C. E. Birgfeld. (*Canning Age*, 1930, October, p. 681.)

416. Determination of Tartaric Acid in Fruits and Fruit Products. B. G. Hartman and F. Hillig. (*Glass Packer*, 1930, September, p. 441.)

417. The Use of Raisins and other Grape Products in Candy and Ice-Cream. W. V. Cruess. (*Fruit Prods. Journ.*, 1930, September, p. 5.)

418. Vintage Flavours without Alcohol. H. Bennett. (*Ibid.*, p. 16.)

419. Determination of Citric Acid in Fruits and Fruit Products. B. G. Hartman and F. Hillig. (*Journ. Assoc. Official Agric. Chemists*, 1930, Vol. 13, p. 99.)

420. Conservation of Fruit Juices with Formic Acid. A. Hanak. (*Biochem. Zeitschrift*, 1930, Vol. 221, p. 467.)

421. Pineapple Canning in British Malaya. C. H. Boehringer. (*Canner*, 1930, No. 17, p. 13.)

422. Vitamins in Canned Foods.—IX. Tomato Products. Kohman, Eddy, and Zall. (*Ind. Eng. Chem.*, 1930, September, p. 1015.)

423. Gelation of Fruit Juices. W. Ziegelmayer. (*Kolloid-Z.*, 1930, p. 243.)

424. Chemical and Bacteriological Examination of Lemonade. C. Dupont. (*Ann. Falsif.*, 1930, p. 141.)

425. Methylene Blue in Tinned Peas. D. Henville. (*Analyst*, 1930, October, p. 629.)

426. Vitamins in Dried Fruits.—II. Effect of Drying and of Sulphur Dioxide upon Vitamin A Content of Fruits. A. F. Morgan and A. Field. (*Journ. Biol. Chem.*, 1930, p. 9.)

Cereal Products

427. The Manufacture of Rice Starch. A. E. Williams. (*Ind. Chem.*, 1930, October, p. 387.)

428. Baking Value of Flour and Possibility of Determining it in the Laboratory. A. Tasman. (*Chem. Weekblad*, 1930, p. 138.)

429. Measuring the Plasticity of Pastes and Doughs. C. H. Bailey. (*Journ. Rheology*, 1930, p. 429.)

430. Dough-Making. W. P. Ford. (*Arkady Rev.*, 1930, July, p. 58.)

431. The Colloid Chemistry of Bread-Making. R. Whymper. (*Ibid.*, p. 70, and October, p. 117.)

432. The Importance of Sugar in Bread-Making. C. W. Herd. (*Ibid.*, October, p. 98.)

433. Fat as a Bread Improver. R. H. Callow. (*Ibid.*, p. 102.)

434. The Starch in Flour and Bread. W. P. Ford. (*Ibid.*, p. 107.)

435. The Manufacture of Compressed Yeast. (*Ibid.*, p. 117.)

Dairy Products

436. The Sterilisation of Sweet Cream for Market Purposes. B. H. Webb. (*Journal of Dairy Sci.*, Vol. 13, No. 3; reprinted *Glass Container*, 1930, September, p. 18.)

437. Dairy Lay-out and Plant. (Various articles in *Food Industries*, 1930, October.)

438. Testing of Casein for Technical Purposes. H. Ulex. (*Chem. Ztg.*, 1930, p. 421.)

439. Relation between Constants of Butter-Fat. O. Laxa. (*Ann. Falsif.*, 1930, p. 159.)

440. Further Work on the Refractometer in Milk Analysis. G. D. Elsdon and J. R. Stubbs. (*Analyst*, 1930, October, p. 618.)

Various

441. Soya-Bean Extract Residues from Different Processes. P. Malkomesius and W. Schramm. (*Landw. Versuchsstat.*, 1930, p. 33.)

442. Deterioration and Spoilage of Honey in Storage. G. E. Marvin. (*Journ. Econ. Entomol.*, 1930, p. 431.)

443. Methods Used to Detect Heated Honeys. G. H. Vansell and S. B. Freeborn. (*Ibid.*, p. 428.)

444. Pollen Analysis of Honey. C. Griebel. (*Z. Unters. Lebensm.*, 1930, p. 63.)

445. Malt Sugar in Mayonnaise: A Basic Formula for Mayonnaise. W. M. Brownell. (*Oil and Fat Industries*, Vol. 7, p. 99.)

446. Remarks on the Defective Qualities of Bread. (i) The Bread-making Qualities of Flour; (ii) Toxic Symptoms attributable to the Consumption of Bread. A. Urbain and J. Barotte. (*Rev. Path. Comp. et Hyg. Gen.*, 1929, Vol. 29, pp. 1-12. 2 refs.)

447. The Shelf Life of Mayonnaise. A. L. Sodergreen. (*Glass Container*, 1930, September, p. 8.)

448. Control of Raw Material in the Mayonnaise Plant. A. K. Epstein and B. R. Harris. (*Canner*, 1930, Nos. 12 and 17.)

449. Aluminium in the Chemical Industry. H. V. Churchill. (*Ind. Eng. Chem.*, 1930, September, p. 993.)

450. The Agar Industry in California. G. R. Robertson. (*Ind. Eng. Chem.*, 1930, October, p. 1074.)

451. Dry Ice. D. H. Killeffer. (*Ibid.*, p. 1087.)

452. Normal and Modified Foaming Properties of Whey-Protein and Egg-Albumin Solutions. P. N. Peter and R. W. Bell. (*Ibid.*, p. 1124.)

453. Composition of European and Californian Almonds. C. V. Hart. (*Ibid.*, p. 1128.)

454. Determination of Crude Fibre in Cocoa and Chocolate. J. Ruffy. (*Chem. Zentr.*, 1930, p. 1239.)

455. The Chemical Constitution of the Carotenoid Pigments and the Relation of Carotene to Vitamin A. J. M. Gulland. (*Journ. Soc. Chem. Ind.*, 1930, No. 41, p. 839.)

456. Further Observations on the Relation of Carotene to Vitamin A. Drummond, Ahmad, and Morton. (*Journ. Soc. Chem. Ind.*, 1930, p. 291 T.)

(*Continued from page* 340.)

CHEF.—512,910. **Tomato catsup, relish, salad cream, and vinegar.** E. LAZENBY AND SON, LTD., 20, Soho Square, London, W. 1. October 15. (Associated.)

DUCAL.—514,930. **Vinegar (for food).** THE DISTILLERS CO., LTD., Kinnaird House, 2, Pall Mall East, London, S.W. 1. October 15.

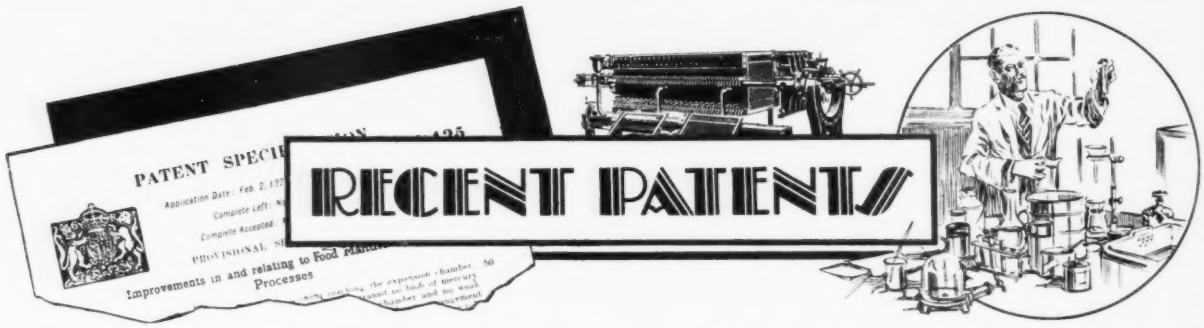
MELBREW.—514,626. **Tea and coffee.** THOMAS ARCHIBALD MELROSE, 22, Broughton Place, Edinburgh. October 15. (By Consent.)

SPONGELLA.—515,470. **Flavouring and colouring preparations (being non-alcoholic ingredients in food) for use in baking.** WALFORD AND CO., LTD., 63-65, St. Oswald Street, Collyhurst, Manchester.

MIRIAM'S FOOD.—514,165. **A compound of cereals for use as food.** HYMEN HENRY REDGRAVE, St. George's, 10, Station Road, Watford, Hertfordshire. October 8.

EGRET.—515,705. **Canned fish.** HERBERT GRIFFITH KINGHAM, trading as HERBERT G. KINGHAM AND CO., The Stores, Station Road, Dorking, Surrey. October 8.

YIP YAPS.—515,798. **Cakes, biscuits, and sweetmeats.** H. THOMPSON AND CO.'S IDOLICE SPECIALITIES, LTD., 20, Prospect Row, Birmingham. October 8.



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Latest Patent Applications

28855. BENNETT, W. G., AND DISTILLERS CO., LTD. : Manufacture of yeast. September 26.

28341. COHNITZ, E. : Apparatus for making whipped cream, etc. September 22.

28140. BARBOUR, J. A., AND SOUTHHOOK POTTERIES, LTD. : Appliance for serving food slices. September 20.

27551. BERTEL, R., AND SCHUSSLER, O. : Manufacture of yeast. September 15.

28104. JANOT, P. G. : Canning foodstuffs. September 19.

27518. LAVENDER, P. C. : Preserving fish. September 15.

Specifications Published

314,401. KREBSER, A. : Apparatus for sterilising fruit and other foodstuffs.

334,863 BERGSVIK, A., VITACREAM, LTD., AND HELLERUD, R. : Manufacture of artificial cream.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2., at the uniform price of 1s. each.

Abstracts Published

332,209. **Storing fruit and vegetables.** MILANI, E., 21, Drumm Street, San Francisco, U.S.A. February 16, 1929, No. 5197. [Class 49.]

Fresh, ripe fruit and vegetables are stored for a limited period against deterioration by hermetically sealing the product in the presence of an inert gas and then minutely venting the container prior to, or very soon after, the product generates its own gas, and at about the time it begins to sweat, and permitting the said vent to remain open. The vented container is preferably stored at a relatively low temperature, as, for example, 30° to 35° F. The inert gas may be introduced into the container by burning a material within the container, or the container and contents may be subjected to a vacuum followed by the addition of carbon dioxide or other inert gas. By way of example, the period during which the container is kept sealed prior to venting in the case of strawberries is two days, apricots three days, and pears five days.

332,241. **Fish meal.** HASLAM, W. H., 8, Hanover Terrace, Regent's Park, London. April 16, 1929, No. 11731. [Classes 5 (i), 5 (ii), 49, and 59.]

Fish meal or powder is obtained from fish offal or other ordinarily inedible or waste fish material by a continuously operated process which includes sterilising the material, then disintegrating and finally drying it.

332,378. **Making wafer biscuits.** BALTON, J., 420, South Mount Street, Baltimore, U.S.A. June 28, 1929, No. 19902. [Class 28 (i).]

332,456. **Moulding confectionery.** SÖHNE AKT.-GES., D., 22, Äussere Delitzscherstrasse, Halle-on-Saale, Germany. September 19, 1929, No. 28476. Convention date, August 23. [Class 87 (ii).]

333,677. **Coating bakers' goods.** VICARS, LTD., T. AND T., Earlestown, and TUNSTALL, H. H., 15, Crow Lane East, both in Newton-le-Willows, Lancashire. June 8, 1929, No. 17657. [Classes 28 (i) and 117.]

333,508. **Dressing fish.** FAIRWEATHER, H. G. C., 65, Chancery Lane, London.—(Maritime Fish Corporation, Ltd., 353, St. Nicholas Street, Montreal, Canada.) February 22, 1929, No. 4661. [Class 28 (ii).]

A machine for cutting fish into fillets and removing the backbones.

332,949. **Sterilising liquids.** ENOCK, A. GRAHAM-, AND GRAHAM-ENOCK MANUFACTURING CO., LTD., Margaret Street Works, Stamford Hill, London. March 26, 1929, No. 21582/30. Divided on 332,912. [Classes 49 and 78 (i).]

332,847. **Treating wheat-germ.** WANKLYN, K. P., Dale Cottage, Allesley, Coventry, and STACEY, F., 54, Poplar Avenue, Edgbaston, Birmingham. October 31, 1929, No. 33113. [Class 58.]

Wheat-germ is rendered suitable for use as an edible food substance by heating under a partial vacuum for a sufficient period to remove moisture from the germ without damaging or removing vitamins or other nutritive matter. The wheat-germ is maintained at a temperature of about 135° F. for 8 hours in a closed vessel in which a vacuum of from 20 to 27 inches of mercury is maintained. The germ, after drying, may be ground to a flour or pounded to a granular or flaky form. The air exhausted from the heating chamber may be replaced by a gas such as nitrogen or nitrogen peroxide.

333,233. **Butter.** SALENIUS, E. G. N., AND SALENIUS, E. S., 91, Nybrogatan, Stockholm. May 7, 1929, No. 14277. [Class 84.]

333,158. **Biscuit-making plant.** VICARS, LTD., T. AND T., AND CROSLAND, E. M., Earlestown, Newton-le-Willows, Lancashire. April 2, 1929, No. 10134. [Classes 28 (i), 51 (ii), and 78 (i).]

Recent Trade Marks

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal," and is published by permission of the Controller of H.M. Stationery Office.

LETONA.—513,978. **Canned fruits, dried fruits, canned vegetables, and jams.** WATER CONSERVATION AND IRRIGATION COMMISSION, New South Wales, Australia House, Strand, London, W.C. 2, and Union House, George Street, Sydney, Australia. October 15. (By Consent.)

(*Continued on page* 339.)